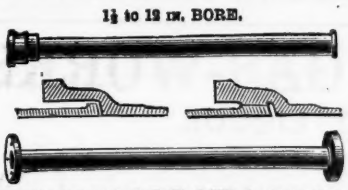
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXII. No. 1582.] LONDON, SEPTEMBER 5, 1893. [45TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1½ to 12 IN. BORE.



THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

GLASGOW OFFICE: 24, GEORGE SQUARE.
Telegrams:
"BONLEA, STOCKTON-ON-TEES."
"SPRINGBANK, GLASGOW."

— ESTABLISHED 1830. —

PARKER & LESTER,

Manufacturers & Contractors.

THE ONLY MAKERS OF

PATENT ANTIMONY PAINT,

Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD,
LONDON.

WOLSTON'S

TORBAY PAINTS

Special Quotations to Gas Companies.

DARTMOUTH, DEVON.

Lanemark Coal Co.,

LIMITED.

LANEMARK CANNEL

AND GAS COALS.

Quotations and Analysis on application to

LANEMARK COLLIERY,

NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

THE "C" BURNER.

NEW HIGH-POWER GAS-LIGHT.

INCANDESCENT GAS-LIGHT SYSTEM.

Consumes

4 cubic feet per hour.

Gives a light of

70 to 80 candle power.

Brilliant Light.

Perfectly Steady and

Noiseless.

Smokeless.

Reduced Heat.

Can be attached to any Gas-Fittings.

THE TRIUMPH OF GAS OVER ELECTRIC LIGHT.

Taking Gas at 3s. per 1000 cubic feet and Electric Light at 8d. per Board of Trade unit, the "C" Burner will produce an equal amount of light at **One-eighth the cost of Electric Light.** This cannot be disproved.

Prices and particulars on application to

THE INCANDESCENT GAS-LIGHT COMPANY, Ltd.,

14, PALMER STREET, WESTMINSTER, LONDON.

Near St. James's Park Station.

SAWER AND PURVES,

LATE

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMERS' WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

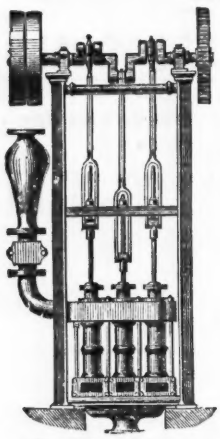
AND

IMPROVED DRY GAS-METERS.

SPECIALITY: PATENT CASH PREPAYMENT METERS.

STEAM & HAND PUMPS FOR GAS-WORKS,

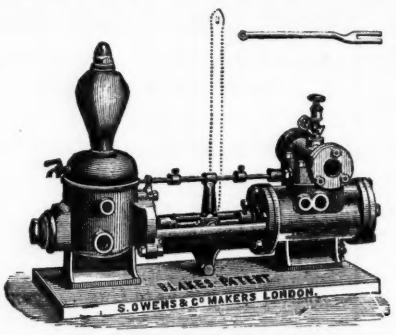
FOR PUMPING TAR, WATER, AND LIQUOR.



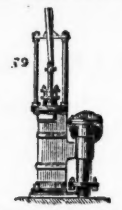
Treble-Barrel Pumps in Frame.

Syphon Pump.

Double-Barrel Force-Pump in Frame.



BLAKE'S
PATENT
STEAM PUMPS.
20,000 IN USE.



Improved Double Action Pump.

Cast-Iron Hand-Pump.

Wrought-Iron Portable Pump.

S. OWENS & CO., Hydraulic, Gas, & General Engineers, WHITEFRIARS ST., LONDON, E.C.

SOLE MANUFACTURERS OF

MANN & OWENS' PATENT SCREW & CAM, also FULL-WAY RACK & PINION GAS-VALVES.

S. O. and Co.'s New Catalogue of Gas Apparatus and General Machinery can be had on application.

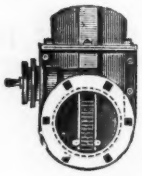
NEWTON, CHAMBERS, & CO., LIMITED,

THORNCLIFFE IRON-WORKS, near SHEFFIELD,

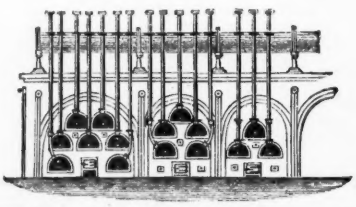
MANUFACTURERS OF

SLIDE VALVES,
WITH RACK & PINION
OR
Internal or External
SCREWS, of all Sizes.

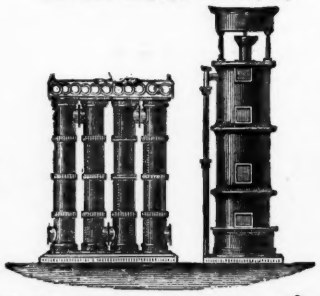
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description,
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

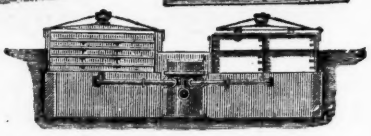


WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



PATENT
CENTRE-VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

THE BARROWFIELD IRON-WORKS, LIMITED,

LONDON OFFICE:
6, LITTLE BUSH LANE, CANNON STREET.

Late LAIDLAW, SONS, & CAINE, Limited,

Telegraphic Address:
"GASOMETER."

GLASGOW.

MANUFACTURERS OF ALL KINDS OF GAS PLANT.

RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES;
CONDENSERS, EXHAUSTERS, AND ENGINES; SCRUBBERS, WASHERS;
PURIFIERS, WITH PLANED AND CEMENT JOINTS;
DRY AND HYDRAULIC CENTRE-VALVES;
HYDRAULIC AND HAND-POWER LIFTING APPARATUS;
GASHOLDERS, SINGLE-LIFT & TELESCOPE; CAST & WROUGHT IRON TANKS;
STATION METERS; GOVERNORS; SCREW AND RACK VALVES;
FOUR-WAY COCKS AND HYDRAULIC VALVES;
CAST-IRON GAS, WATER, & STEAM PIPES & CONNECTIONS; WROUGHT-IRON TUBES & FITTINGS;
IRON ROOFING, MARKET BUILDINGS, BRIDGES, GIRDERS, STEAM BOILERS;
PROMENADE PIERS AND LOADING WHARVES.

MANUFACTURERS OF OIL PLANT OF EVERY DESCRIPTION.

HENDERSON'S Patent Retorts, Condensers, Stills, Cast and Wrought Iron Tanks, Ammonia Stills, Wrought-Iron Gas-Mains, &c., &c.

DESCRIPTIVE SPECIFICATIONS AND ESTIMATES ON APPLICATION.

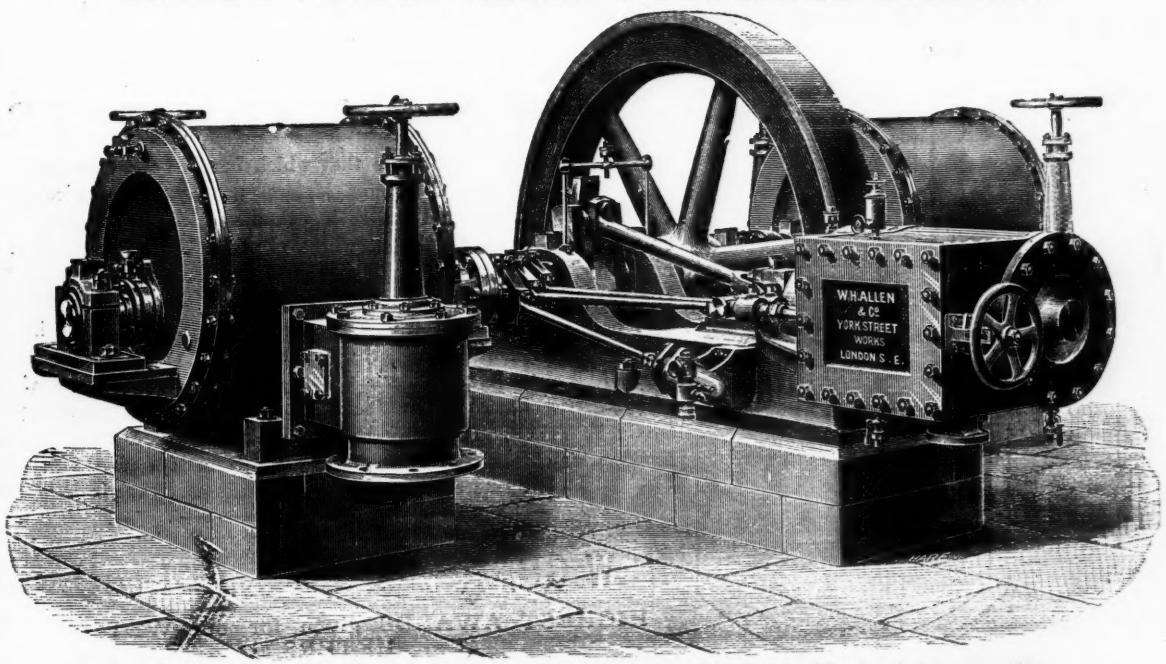
W. H. ALLEN & CO.,

York Street Works, LAMBETH, LONDON, S.E.,

MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.

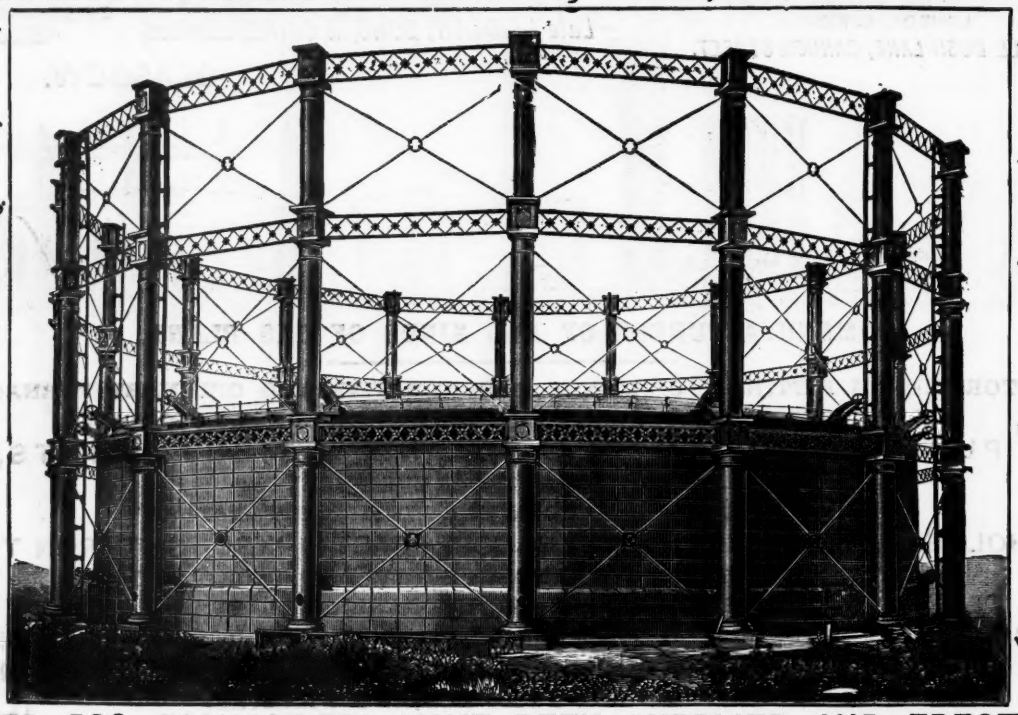


Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

THOMAS PIGGOTT & CO., LTD., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS RETORT. FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED PIPES, FOUL MAINS, RETORT-LIDS, WROT & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

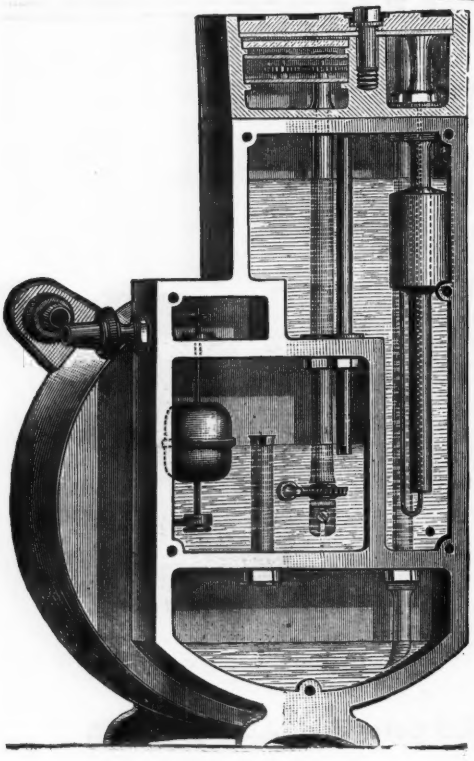
BATH.	BOLTON.	BRISTOL.	CHELTENHAM.	LEAMINGTON.	PRESTON.	SHEFFIELD.
BELFAST.	BOMBAY.	BRISBANE.	HARTLEPOOL.	LIVERPOOL.	READING.	STOCKHOLM.
BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
BIRMINGHAM.	BRIGHTON.	COVENTRY.	LEICESTER.	OLDHAM.	SOUTH METRON.	VIENNA.

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.



Sole Makers of Green's Patent Underground Wet Gas-Meters for Street Lighting, &c., and Ogden's Patent Spindle Tube for Wet Gas-Meters.

GREEN'S PATENT UNDERGROUND METER

Has been designed to obviate that which has hitherto prevented the general adoption of underground Meters—namely, their serious cost. No box is required, and the saving thus effected as compared with ordinary underground Meters, where either a box or meter-pillar is necessary, is fully one-half. The price of one for three lights is 28s., and the other sizes are correspondingly cheap. When fixed, the only part of the Meter exposed to view measures 6½ inches by 8½ inches. By the Indicator with which the Meter is fitted, the Inspector can at once discern whether water is required; but as the Meter is of the compensating description, water will probably need only be supplied ONCE A YEAR. It is advisable to fill the Meter with a non-freezing liquid, which does not injure the fittings; and this can be supplied at about 1s. 3d. per gallon.

Prices and all Information on Application.

NEW GRANGE WORKS, EDINBURGH.

HIGHEST AWARDS given for our WET and DRY METERS at

Exhibitions held at GLASGOW, CALCUTTA, and EDINBURGH.

HEATHCOTE GAS COAL.

RICH IN ILLUMINATING POWER AND YIELD OF GAS.
ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., Ld., CHESTERFIELD.

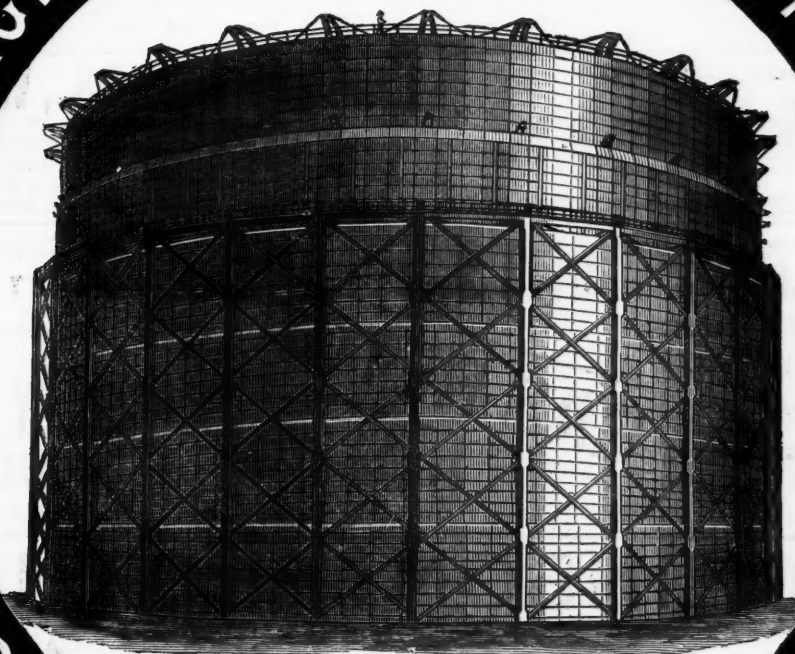
CLAYTON SON & Co LTD

MAKERS OF

WORKS LEEDS

THE LARGEST GASHOLDER IN THE WORLD.

GASHOLDERS OUR SPECIALITY



CAPACITY 12 MILLION CUBIC FT.

ERECTED AT EAST GREENWICH FOR THE South Metropolitan Gas Company
IT HAS SIX LIFTS 30 FT. DEEP EACH AND IS 300 FT. DIAR.

MAKERS OF GAS PLANT OF EVERY DESCRIPTION

ROOFS PURIFIERS &c. ALSO

ADDRESS LONDON 60, QUEEN VICTORIA ST.

TELEGRAPHIC "GAS, LEEDS."

GASHOLDERS OF ANY SIZE

ERECTED & COMPLETED WITHIN 12 MONTHS AND AT THE TIME SPECIFIED

CONVEYING MACHINERY

FOR GAS AND OTHER WORKS.

WEST'S GAS IMPROVEMENT Co. LTD.

ENGINEERS, IRONFOUNDERS & CONTRACTORS

JOHN WEST, M. INST. C.E.
MANAGING DIRECTOR.

MILES PLATTING
MANCHESTER.

Wrought-Iron

TUBES

And Fittings and Accessories.

LAMBERT BROS., WALSALL,

MANUFACTURERS OF
WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM,
BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

INCLINED RETORTS,

FIRE BRICKS,
LUMPS, TILES,
BLOCKS, &c.

Special Bricks for Intense Heats.

GAS RETORTS.

CASTINGS AND
EVERY REQUISITE
FOR
GAS-WORKS.

MOBBERLEY & PERRY,
Fire-Brick Works, STOURBRIDGE.

☞ Retort Setters sent to any part of the Kingdom.

HUTCHINSON BROTHERS,

GAS ENGINEERS, &c.,
MANUFACTURERS OF

Improved Wet & Dry Gas-Meters.

STATION-METERS. LAMP-METERS.

Test Gasholders and General Gas Apparatus.

Brass Main & Lamp Taps. Unions, Ferrules, &c.

The "Falcon" Lamplighter's Torch. Service Cleansers.
SYPHON AND OTHER PUMPS.
WOOD AND WROUGHT-IRON PURIFIER-GRIDS. SCRUBBER BOARDS.
WET AND DRY METERS REPAIRED.

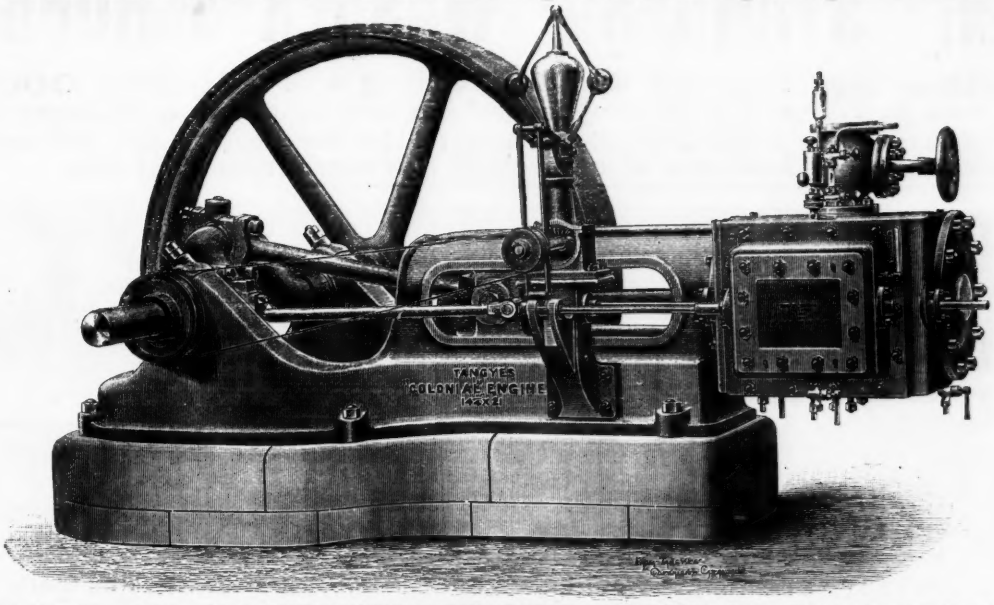
FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

TANGYES'

"COLONIAL" STEAM-ENGINE

Constructed for Steam Pressures up to 100 lbs. per square inch.



Tangyes' "Colonial" Steam-Engine, with the TANGYE-JOHNSON PATENT AUTOMATIC CUT-OFF GEAR. From a Photograph of the 14½ in. by 21 in. size.

PRICES QUOTED ON RECEIPT OF THE NECESSARY DATA.

TANGYES LIMITED, Cornwall Works, BIRMINGHAM.

AND LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, BILBAO, ROTTERDAM, AND CALCUTTA.

Telegrams: "TANGYES BIRMINGHAM." *Copyright. Entered at Stationers' Hall. No. 69 E.*

GASHOLDERS

A Four-Lift Gasholder, nearly 200 feet high and 8 million cubic feet capacity, has been recently erected by us for The Gaslight and Coke Company, London.

PURIFYING MACHINES.

PURIFIERS. SULPHATE PLANT.

Weck's Centre-Valve.

C. & W. WALKER,

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

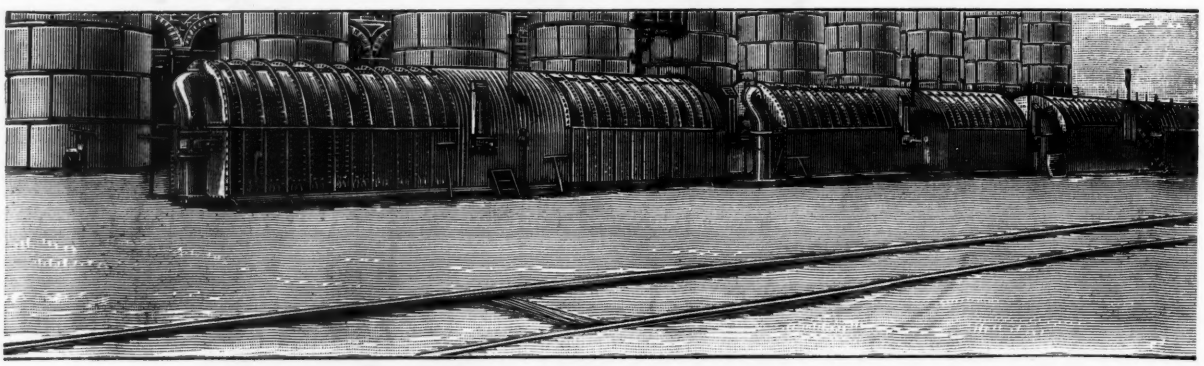
"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

KIRKHAM, HULETT, & CHANDLER, LD.,

Patentees of the

PATENT "STANDARD" WASHER-SCRUBBER.

☞ **465 of these Machines (capable of dealing with 440,807,000 cubic feet of Gas daily) have been supplied, which fact is given as evidence of this apparatus being the Most Efficient of any in the Market for the extraction of Ammonia, Carbonic Acid, and Sulphuretted Hydrogen from Coal Gas.**



View of SIX PATENT "STANDARD" WASHER-SCRUBBERS, erected at the Beckton Station of The Gaslight and Coke Company (the Engines driving same being under Galvanized Iron Covers). This Company has **27** of these Machines in use; and they are also in operation at a great number of Gas and other Works in this Country and abroad.

Address : 3 & 4, Palace Chambers, Bridge St., Westminster, S.W.

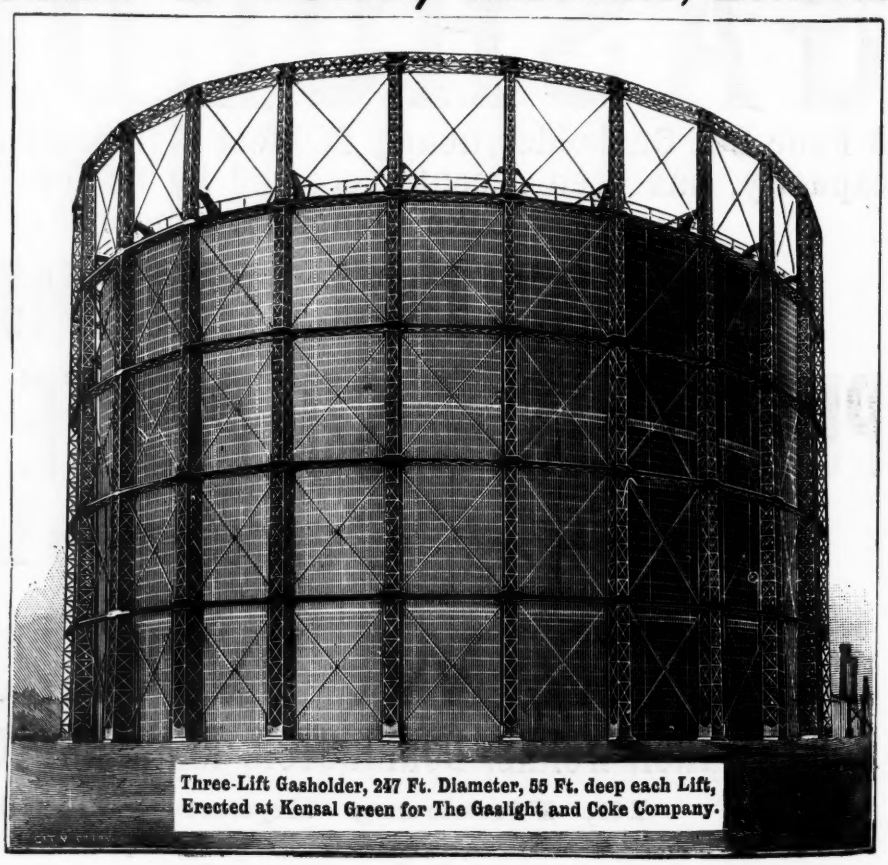
SAML. CUTLER & SONS, MILLWALL, LONDON.

NEARLY

8 MILLION

CUBIC FEET

CAPACITY.

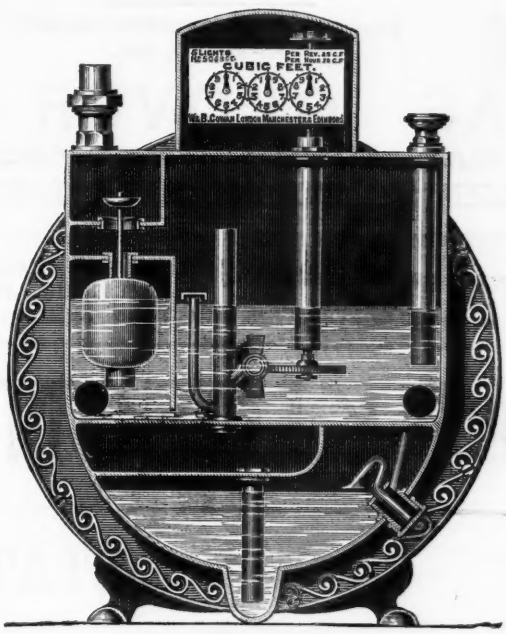


Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift, Erected at Kensal Green for The Gaslight and Coke Company.

W. & B. COWAN'S WET METERS

IN TIN AND CAST-IRON CASES.

A Speciality in our Wet Meters is **THE WARNER AND COWAN DRUM, which ensures accurate registration,** independent of the height of the water-line; whereas, in the ordinary Wet Meter, the evaporation of water tends to make the registration show to the prejudice of the Gas Company.



SECTION OF IRON CASE WET METER.

Another important feature in our Wet Meters is **WM. COWAN'S PATENT SYPHON OVERFLOW,** by which, when watering the Meters, the water-line is attained **with rapidity, certainty, and exactitude;** and it is impossible for any water afterwards to find its way into the waste-box.

THESE METERS STAND HIGH PRESSURES.

FACTORIES

SMITH SQUARE WORKS, WESTMINSTER,	DUTTON STREET WORKS,	BUCCLEUCH STREET WORKS,
LONDON, S.W.	MANCHESTER.	EDINBURGH.
Telephone No. 3250.	Telephone No. 1545.	Telephone No. 753.

TELEGRAPHIC ADDRESSES:

"DISC LONDON." "DISC MANCHESTER." "DISC EDINBURGH."

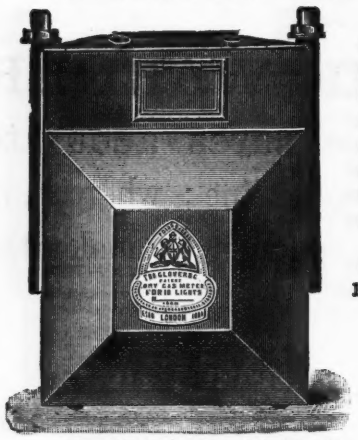
Telegraphic Code used, A.B.C. 4th Edition. Special Code furnished on application.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865. PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;

The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.

Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

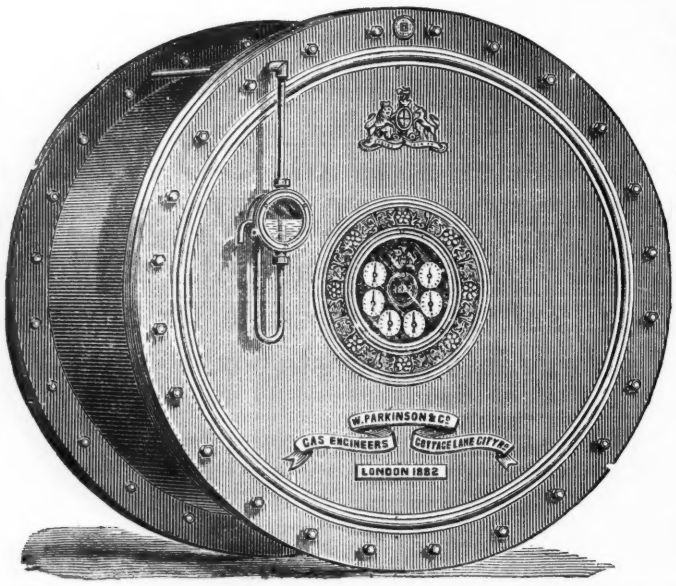
BRISTOL: 62, VICTORIA STREET. *Telegraphic Address*: "GOTHIC."

BIRMINGHAM: 3, BRIDGE ROW, DERITEND. *Telegraphic Address*: "GOTHIC."

LEEDS: BOAR LANE CHAMBERS, 4, BASINGHALL STREET. *Telegraphic Address*: "GOTHIC."

MANCHESTER: 37, BLACKFRIARS STREET. *Telegraphic Address*: "GOTHIC."

W. PARKINSON & CO.



STATION METERS

IN

ROUND or SQUARE TANKS.

FITTED WITH PATENT

THREE-PARTITION DRUMS.

MORE THAN

300 STATION METERS,

Varying in size from **1200** to **200,000** cubic feet per hour, have been sold, fitted with

THREE-PARTITION DRUMS,

Since their introduction.

ROUND METERS as above are kept in Stock in all Sizes ready to send away at the shortest notice. Compact, portable, and very easily fixed. An Improved Overflow Water-line Regulator fitted to every Meter.

DURABILITY UNEQUALLED. SOME HAVE BEEN IN CONSTANT USE FOR OVER 60 YEARS.

COTTAGE LANE WORKS, CITY ROAD, **LONDON.** Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE, **MANCHESTER.** Telegraphic Address: "PRECISION."

[See also Advt., p. 472.

CONTENTS.

EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The House of Lords on Betterment . . . 439
The End of the South Wales Strike . . . 440
The Manchester District Institution at Nottingham . . . 440
The Meeting of the British Association at Nottingham . . . 440
A Coincidence and an Illustration . . . 441
Jean Daniel Colladon . . . 441

WATER AND SANITARY AFFAIRS—

The Proposal to Purchase the Portsmouth Water-Works Rejected by the Town Council . . . 442

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market . . . 442
Electric Lighting Memoranda . . . 442
The Utilization of Energy . . . 443
The Water Undertakings of the Glasgow and Edinburgh Municipalities . . . 444

NOTES:—

The Temperature of Steam from Salt Solutions . . . 445
Electric Heating under Water . . . 445
The Iron Coloration of Natural Waters . . . 445

COMMUNICATED ARTICLE:—

Small Gas Undertakings and Differential Prices. By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S. . . . 445

TECHNICAL RECORD:—

Manchester District Institution of Gas Engineers—Quarterly Meeting at Nottingham . . . 447
Société Technique du Gaz en France—The Papers Presented at the Annual Congress in Paris . . . 449
Pacific Coast Gas Association . . . 450

REGISTER OF PATENTS:—

Purification of Coal Gas—Hood, J. J., and Salamon, A. G. . . . 451
Governing the Speed of Gas-Engines—Andrew, H. H., and Bellamy, A. R. 452
Manufacture of Illuminating Gas—Newton, H. E. (Oakman, R. N.) . . . 452
Gas-Motors—Dougill, J. . . . 452
Patent Notices . . . 453

CORRESPONDENCE:—

Licences for Stills in Sulphate of Ammonia Works . . . 453

MISCELLANEOUS:—

Provincial Gas and Water Companies . . . 453
Crystal Palace District Gas Company—Half-Yearly Report and Accounts 455
Meeting of the Tottenham and Edmonton Gas Company . . . 455
Manchester Corporation Gas, Electric Lighting, and Water Accounts . . 456
The Crisis in the Coal Trade . . . 456
The Portsmouth Town Council and the Water-Works—Rejection of the Proposal to Purchase . . . 458
Nottingham Corporation Water Supply—Annual Reports . . . 458
Artesian Wells . . . 458
Water Supply Works in Italy . . . 459
Notes from Scotland . . . 460
Current Sales of Gas Products . . . 460
Coal Trade Reports . . . 460
Gas and Water Companies' Stock and Share List . . . 461

PARAGRAPHS.—The "Mahler" Calorimeter, 441—The Autumn Meeting of the Incorporated Institution of Gas Engineers, 441—Eastern Counties Gas Managers' Association, 441—South-West of England District Association of Gas Managers, 441—Raising a Large Water-Main, 441—Presentation to the Manager of the Newington Water-Works, 442—Death of the Chairman of the Hastings Gas Company, 443—Private Bill Legislation, 443—Death of Mr. W. Roberts, 444—Presentation to Mr. R. J. M'Connell, of Belfast, 444—The Forthcoming Meeting of the British Association, 446—A Large Syphon, 446—An Unusual Method of Water Purification, 451—Water Companies' Dividends on Old and New Shares, 451—The Finances of the Blackpool Corporation Gas Department, 457—Illegal Use of Water, 457—Scarcity of Water at Leeds, 459—The Recent Electric Lighting Failures at Hastings, 459—Incorporation of Brighouse, 461—Accrington Gas and Water Works Purchase, 461—Accident at the Oundle Water-Works, 461—Auxiliary Water Supply for Rhyl, 461—The Employment of Electricity for Lighting and Motive Power at Blackpool, 461—A Defective Reservoir Embankment at Heywood, 461—Enlargement of a Gasholder at the Elland Gas-Works, 461—The Cost of a New Reservoir at Baildon, 461—The Adoption of Prepayment Meters at Hexham, 461—The New Water-Works for Plympton, 461—The Testing of Gas-Meters in Edinburgh, 462.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

Post-Office Orders should be made payable at the Chief Office, St. Martin's-le-Grand; Cheques crossed "Union Bank of London," and drawn to the order of WALTER KING, 11, Bolt Court, Fleet Street, E.C.

Telegraphic Address: "GASKING LONDON."

Telephone Number: 2789.

THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, SEPTEMBER 5, 1893.

The House of Lords on Betterment.

A SOMEWHAT complicated state of things results from the determination of the House of Lords, as expressed by the debate and division of Thursday last, to abide by their previously recorded opinion, and strike out the Betterment provision from the London Improvements Bill. This measure, with the Betterment clause, has received the emphatic approval of the House of Commons; and the idea that property which is increased in value by a public improvement should bear some proportion of the cost of such improvement is perfectly defensible, as we have freely admitted in previous notices of the matter. Whether the House of Lords have done wisely or the reverse in placing themselves in antagonism to the House of Commons in regard to this particular Bill, is essentially a question of Party politics, with which we have neither desire nor capacity to meddle. It may be supposed that, while a Legislature is divided into two Chambers, it will be competent for one Chamber to disagree on occasion with the other. It is hardly likely, moreover, that the country will get excited over this dispute upon a question of principle, seeing that the practical issue is merely how a sum of not exceeding £150 a year is to be raised out of the resources of all London. The curious thing is that the noble Lord—the Earl of Onslow—who was instrumental in securing the rejection of the particular scheme of taxing "Betterment" proposed in the Bill under notice, professed himself as not at all opposed to the principle; and moreover he declared he had conversed with various landlords in London who had agreed that property should pay something in return for benefits conferred upon it by the expenditure of the ratepayers' money. His Lordship argued, however, that if such a principle is introduced into the law of England, it should be done systematically, and not by a side wind. It is indeed very desirable that everything like passion or prejudice should be kept out of projects of this kind. "Hard cases" proverbially "make bad law;" and it behoves legislatures to be most careful lest they supply examples in proof of the wisdom of the old saw. It is easy to put a case where, by the expenditure of public money upon a street improvement, certain property may be conceivably heightened in value by a very large amount; and it is then natural to ask whether some of this increment should not be intercepted for the purpose of helping to defray the cost of the improvement. At the same time it should not be overlooked that the object of such improvements is not to increase the value of any particular property, but to serve the public interest. If the interest of individual landowners or house occupiers is to be taken into account in any such connection, the matter must in fairness be looked at from both sides, and a possible depreciation be reckoned with, as well as a problematical enhancement. How this is to be done, has never been satisfactorily explained. The President of the Surveyors' Institute has said that "all experienced surveyors are agreed that no plans "put forward for the purpose are even approximately just "or practicable." And where the imagination of surveyors fails, who is to step in and supply what is wanted? The Marquis of Salisbury is one of the amateurs who has no objection to the principle of Betterment. His Lordship goes farther, and admits that it would be a good thing if a mode of applying the principle to town improvements, especially in London, could be discovered, in view of the difficulty of finding where the money for such improvements is to come from. He also said, however, that "because they had an impression that one man paid too "much, and somebody else ought to pay something, it "did not follow that they were absolved from taking any "trouble to get at the right person to pay." The solution proposed in the Bill is that proximity to the improvement determines liability to contribute towards its cost; but this contention does not hold good. The Marquis of Salisbury remarked that, in the case in point, the County Council appeared to think that every street improvement radiates benefits all round it, like light and heat; and he reasonably said that he "could not think where they had got that "idea from." The estimate of enhanced value would be determined by the valuation of experts. But what one expert affirms, another can always be hired to deny; and, as Lord Salisbury observes, "there is no other legal "amusement in this world so expensive as that of fighting "expert evidence." Readers of the JOURNAL do not need to be referred to illustrations in support of the observation. We take an interest in this controversy because its settlement either way must be fraught with wide, and indeed hardly imaginable, consequences. Why, when a wretched congeries of "rookeries" is swept away, and the site becomes filled with handsome buildings, is not the gas undertaking that supplies the town benefited by the opening up of a new district? Is this to be paid for by the owners of the undertaking as a Betterment? If so, on what basis is the valuation to be made? The difficulty of

accounting for the requirements of the "hypothetical "tenant" sinks into insignificance in comparison with that of the prospect thus opened up.

The End of the South Wales Strike.

ONCE more a particularly sad piece of history repeats itself; and the irrational strike of a section of the men engaged in the coal industry of South Wales against the operation of a method of wage regulation, which they had previously adopted of their own free will, comes to a disastrous end. It is quite according to precedent also that the agitators, whose interested counsels precipitated the trouble, and their supporters in the newspaper press, have with one consent dropped the South Wales men like the proverbial "hot potato," and left their dupes to make the best they can of the situation in which unfortunately they now find themselves. Will the workmen never learn the wisdom of looking facts in the face, or acquire the knack of weighing the words of men like Tillett and the vapourings of newspapers like the *Daily Chronicle* against the actualities of their own industrial circumstances? What is the use of Tillett going to South Wales on a special retainer, probably provided by the Miners' Federation, to orate before a crowd of hood-winked men against what he calls the exploded idea that wages in coal mining should be governed by prices, and to argue in favour of the regulation of prices by wages, when he and those who sent him must be perfectly well aware that no amount of verbiage can alter the facts? It would appear from this and other incidents of the late strike that the so-called "practical" man, the man who works with his hands, is of all men the most unpractical, and the easiest to be led away by specious rhetoric vented by demagogues who not only do not work themselves, but live by preventing their dupes from working. It is clear enough that the whole of this trouble in South Wales was fomented by agents of the Miners' Federation for their own ends, which were twofold. In the first place, they wanted to destroy the sliding-scale arrangement, and to restore Trade Unionism to the place in Wales which was lost by its calamitous failure in 1875. Secondly, they sought to intensify the artificial coal famine by cutting off supplies from the South Wales field, which they imagined would improve the prospects of the men in the Federation districts of England. These Federation agents meant to stick at nothing to gain their ends. They began by attacking the personal character of Mr. Abraham, M.P., which was, in the language of the cynic, "worse than "a crime—it was a blunder." Then they inflamed the spirits of the young men, and organized a series of mass meetings as well as marches in force, which were meant to intimidate those men who were content to abide by the sliding-scale, and would certainly have resulted in bloodshed, but for the timely action of the local custodians of law and order. The whole outbreak has been a young men's affair. The older men, who remembered the age of rampant Trades Unionism and the incessant strikes that preceded the long peace due to the sliding-scale, had no desire to stop working; but in some places they were overawed into ostensibly joining in a movement that was condemned by their sober judgment. The members of the Sliding-Scale Committee deserve well of their countrymen for holding fast by the principle of automatic, peaceful adjustment of wages to coal prices in spite of contumely and threats; and they will have their reward. As to the state of affairs in the Federation districts, it is only a question of how long the strikers can hold out. Their leaders last week threw away an opportunity of coming to an agreement with the employers for the opening of negotiations that might have disclosed a way of terminating the dispute. With Durham hostile, and the flank movement in South Wales repulsed, it is impossible that the Federation can long continue to meet the offer of the employers to arbitrate with their unreasonable *non possumus*. There is something very instructive to be gleaned from all this. Yesterday the Trades Congress met in Belfast, and, in all probability, among the hundreds of resolutions which this assembly of Trades Union delegates will amuse itself in passing, there will be several denouncing strikes and locks-out as means of settling labour disputes, and calling for arbitration and conciliation as between employers and employed. Yet some of these very same delegates will have come straight from their futile attempt to wreck one automatic wage-settling arrangement; and others will be fresh from their rejection of an offer of arbitration from the Midland coal owners. Such is life; and very curious it is.

The Manchester District Institution at Nottingham.

THE members of the Manchester District Institution of Gas Engineers on Friday and Saturday last held a most successful and interesting meeting at Nottingham, under the presidency of Mr. W. R. Chester, the Gas Engineer to the Nottingham Corporation. The place of meeting being a far cry from the headquarters of the Institution, it was determined to try the experiment of a *quasi* two-days' gathering, for which there was the greater inducement in the circumstance of there being much to see in the way of gas lighting in Nottingham, which must have been lost if the visitors had had only the Saturday to spend in the town. Accordingly the proceedings were arranged to begin (soon after the arrival of an afternoon train from Manchester) on Friday evening, when the President conducted the members to the Castle Museum and the Natural History Museum at University College. Here an extensive installation of lighting and ventilation by gas has recently been applied under the auspices of the Corporation Gas Committee. The success with which Mr. Chester has, in this instance, solved the problem of lighting a museum collection—always a difficult task—deserves great praise. The next morning began with an inspection of some new street subways; and the whole of the day was profitably occupied in successive visits to the Eastcroft Gas-Works, now under process of reconstruction from the President's designs; the Basford Gas-Works; and the Giltbrook Chemical Works. The Gas Committee entertained the members at luncheon at Basford, where also the small amount of formal business on the *agenda* was transacted. Mr. Chester spared no pains to exhibit the character and extent of his work in Nottingham to the visitors, who could not fail to be impressed both with a due sense of the amount of responsibility and labour that attaches to the post of Gas Engineer to a large undertaking where everything is done under the same organization, and with respect for the able manner in which these onerous and varied duties are discharged by Mr. Chester.

The Meeting of the British Association at Nottingham.

THE British Association for the Advancement of Science will meet in Nottingham on the 13th inst.; and from the preliminary announcements that have appeared in the newspapers, it may be gathered that the proceedings will be well up to the average of modern years in interest and importance. It is remarked in *The Times* that the Association met in the same town 27 years ago; and a somewhat invidious comparison is made between the standing of the organization at that epoch of its existence and its present condition. The President of the last Nottingham meeting was Sir William Grove, then Mr. Grove, Q.C., whose great work on "The Correlation of the Physical Forces" had newly raised him to the front rank as an investigator and thinker. The President this year is Professor Burdon Sanderson, one of the most eminent of living physiologists; and it can hardly be said with truth that the Association has fallen off in the matter of the standing of its principal figure. If the Association is no longer quite the same in the regard of the scientific world as it was a generation ago, this is due quite as much to the changed conditions of the time as to its own composition. Then scientific men were opening up a vast extent of new ground; and many burning questions came up for discussion in its sections. Darwin, Joule, Huxley, and Grove himself were carrying the rule of law into realms where irresponsible speculation had till then ever reigned supreme; and many time-honoured beliefs and opinions had necessarily to be ruthlessly knocked down in the process. All this is now past; and the majority of the combatants of that stormy period are beyond the care of such things. Professor Sanderson will not be called hard names by anybody for whatever he may have to advance in his address; and the Sectional Presidents will also be free to say the things they will without being put in the controversial pillory. There does not seem to be any great promise of papers likely to be specially interesting to followers of the gas industry; but one of the popular lectures is to be given by Professor Smithells, on the subject of "Flame;" and the lecture to working men has been entrusted to Professor Vivian B. Lewes, who has chosen for his theme

"Spontaneous Ignition"—a subject upon which he has already discoursed before the Naval Architects, with more special reference to the spontaneous combustion of coal cargoes. If for these two lectures alone therefore, the Nottingham meeting of the British Association will not be barren of instruction for gas engineers and managers.

A Coincidence and an Illustration.

COINCIDENCES are continually showing themselves as one plods along the pathway of life, to which, indeed, they contribute some much-needed romance. It is not a little curious that within a day or two after the appearance of last week's JOURNAL, with our burlesque suggestion of the advantage that might accrue from the formation of Trades Unions of One Man, there was published in the *Pall Mall Gazette* an account of the actual establishment of such a Union—or to be strictly correct, a Trade Union constituted of one Lancashire collier and his two sons, also colliers. This is near enough to our sketch to warrant notice of it as a coincidence, and also as another proof that truth is occasionally stranger than fiction. The organization in question was discovered by the newspaper correspondent sitting on an overturned broken coal-truck, watching the surface men loading up from the mounds of slack that had accumulated round the pit. He was "playing," like the other Union hands, with whom he had been in full society membership until five years ago, when reflection upon the little that ordinary non-official members got out of the Union compared with what they paid in, resulted in his arriving at the conclusion that the "deligits" were the only men who profited by the system. Accordingly he and his sons, after discussing the situation, resolved to leave the Union and form a better one of their own. The same day they had a strong money-box made without lock or key; and they all three arranged to put into the box exactly the same amount as they would have paid into their old Society, even to the occasional levies that were made by the Union Executive. Thus the box would always hold the sum which the three men would have subscribed to the Union if they had remained members. Then came the strike, in commencing which the family union had probably as much real voice as its members would have had under the former arrangement—that is to say, they had no option in the matter. At any rate, they found themselves out of work; and they forthwith "brust "oppen th' box, and fund ovver eighty pund in her." While the head of the organization was telling this to the newspaper representative, the sound of the inevitable brass band of militant Trades Unionism reached his ears, causing him to remark that the deluded men who were marching in procession had been paying into the Union for years, and had not a brass farthing to draw. They were, in point of fact, begging. Some were starving—"clemmin" as he put it—already; and he opined that they would have to "clem wur afore th' deligits'ill let "'em give in." He denied the impeachment of being a blackleg, declaring his intention of "playing" until the strike should be over; but avowing that he was not such a fool as to give all his "brass" to a Union delegate, and then want it himself. This is as vivid a denunciation of Trade Union management as it has been conducted down to the present time as we have ever seen in all the voluminous newspaper chronicles of the subject. It is a sign of the dry rot which has set in through the unsatisfactory character and behaviour of many Union leaders, who have done more to ruin the cause they profess than could have been wrought in the same time by its bitterest foes from without.

Jean Daniel Colladon.

GAS engineers are very proud of their Murdoch, and with ample reason; for he was not merely the founder of the gas industry, but also a fine sample of the "all-round" master mechanic. Since Murdoch's time there have been several notable examples of men whose devotion to the routine of gas making has not prevented them from doing good work in other branches of engineering; and one of the most eminent of these was Jean Daniel Colladon, who died on June 30 at Cologny, near Geneva, at the ripe age of 91. This Swiss engineer and physicist was a remarkable man, and his long life was devoted to pursuits of the kind that advance material civilization rather than bring the worker either fame or emolument. At the age of 22, Colladon received from the Society of Science of Lille a first prize for the invention of a photometer. In the year 1844, he was appointed Engineer to the new Gas Company of Geneva; and in the same year the British Admiralty adopted his dynamometer for the measurement of the horse power of marine engines. He is credited with many improvements in gas lighting; and he built several gas-works in Switzerland, and the works at Naples. Nothing came amiss to Colladon—electricity, hydraulics, optics, horology. He studied all branches of mechanical and physical industry, and everywhere left traces of his fruitful genius. It was he who was the inventor of the luminous fountains that have been such a striking attraction of recent exhibitions; but the greatest triumph of his life was the invention of the compressed air boring-machine, which rendered possible the piercing of the Alps by the tunnels of Mont Cenis and St. Gothard. This success was achieved by dint of much preparatory experiment conducted at the Geneva Gas-Works, where as early as 1849 Colladon began investigating the circulation of compressed gas in pipes. We have gone a little out of our usual course in mentioning in these columns the death and the labours of the Geneva gas engineer, because he was one of the truly great men whom the profession can claim as its own, and because we would not have it appear that British gas engineers are oblivious of the merits of men like Colladon, who are true intellectual heirs of Murdoch, albeit they may speak a strange tongue, and do their life-work in a foreign land.

The "Mahler" Calorimeter.—It may be interesting to our readers to know, in connection with the translation, in last week's JOURNAL, of M. Aguitton's paper read before the Société Technique du Gaz en France, as well as the communication by Mr. Thwaite appearing in our issue for the 22nd inst., that Messrs. Bryan Donkin and Co., Limited, of Southwark Park Road, S.E., can answer any question addressed to them as to the "Mahler" calorimeter, as they are now making these instruments in the ordinary course of their business.

The Autumn Meeting of the Incorporated Institution of Gas Engineers.—A preliminary intimation has been sent to the members of the Institution that the autumn meeting this year will be held at Portsmouth on the 3rd and 4th prox. In addition to inspecting the Portsea Island Gas-Works, and other gas-works in the locality, it is proposed to visit the Portsmouth Dockyard and the extension works of the Southampton Docks. The afternoon of the second day will be devoted to an excursion to Cowes, and to the Queen's residence, Osborne House.

Eastern Counties Gas Managers' Association.—The Eastern Counties Gas Managers' Association will hold their half-yearly meeting at Melton Mowbray on the 13th inst. The members will be kindly entertained at the gas-works by the Directors of the Company before the business of the day commences. This will be transacted at the Memorial Hall; and among the items for consideration will be a paper on "Gas-Cookers" by Mr. W. H. Manwaring, and one on the "Purification of Coal Gas," by Mr. J. G. Hawkins. The latter especially should give rise to a good discussion. Dinner will be subsequently served at the George Hotel.

South-West of England District Association of Gas Managers.—The programme of arrangements for the half-yearly meeting of this Association, to be held at Exmouth on the 12th inst., has been issued. The members will first take luncheon at the Imperial Hotel, where the meeting will also be held. There is very little, besides the usual formal business, on the *agenda*. The President (Mr. E. C. Riley) will make a few introductory remarks; and then the members will proceed to discuss the paper read at the last meeting by Mr. W. Stagg, entitled "Notes on the Manufacture of Gas." Mr. S. W. Durkin will follow with a paper on main-laying. The local gas-works will be open throughout the day for the inspection of the visitors.

Raising a Large Water-Main.—The process of raising a 48-inch main is described in the last annual report made by Mr. J. L. Ogden, of the Water Bureau, Philadelphia. Owing to a change of grades in some of the streets, the main had to be elevated as much as 11 feet in some places. The work was done by uncovering the pipe, and driving piles on both sides at the back of each bell. Every alternate pair of piles extended high enough to be capped with a 12 in. by 12 in. yellow pine timber, through which two V-threaded screws 1¾ inches in diameter extended to each side of the pipe, where they were connected to an ordinary 48-inch band. The screws were raised by means of nuts having long arms by which they could be turned; and as soon as the pipe was lifted to a sufficient height in the rear, the intermediate piles were capped, so that it could rest on the timbers, the rear set of screws taken to the front, and this operation repeated. At one place there was an angle of 45° in the main, and here extra piling was driven to prevent the joints from parting. The weight lifted was 1500 lbs. per linear foot; and the total weight on each pair of screws was 37,500 lbs. The main was full of water and in constant use while it was being raised.

WATER AND SANITARY AFFAIRS.

THE impetuous financial policy which is observable in some large towns, cannot be laid to the charge of the Portsmouth Corporation. At a meeting of that body held last Tuesday, the report of a Special Committee in favour of purchasing the local water-works was brought up for discussion—perhaps it should be said for further discussion. Undoubtedly the question has been before the Town Council, or in some way under consideration, for the last decade; and the Special Committee, the result of whose deliberations was embodied in the report, have themselves been engaged, at intervals, for more than two years past in digesting the whole subject and mastering their mission. In the result, as we mentioned recently, the Committee recommended that the purchase should be proceeded with. Thus far the matter has gone, but no farther; for, by nineteen votes against fourteen, the Council have refused to adopt the report. The operating reason for this attitude of masterly inactivity, does not appear on the surface of the discussion. The result, indeed, seems at first sight to be due to certain minor considerations which were diligently "trotted out" by those who took part in the debate. Some of the speakers expressed themselves willing to buy the undertaking on "reasonable "terms;" but their view of what is reasonable was not very clearly enunciated. Others betrayed considerable alarm at the results obtained in certain towns in which the water supply is already in the hands of the Local Authorities. Seventeen towns were referred to as showing a balance on the wrong side of the account; while there was a list of fourteen in which water supply shows a profit. Would Portsmouth show a profit? That, of course, would depend in large measure on the further growth of the town (about which some of the councillors were sceptical), and also on the period over which the redemption payments could be extended. The redemption question would be more or less a "dark horse" until the Bill came before Parliament and the Local Government Board. An opponent of the purchase scheme did not think that a redemption term of one hundred years would be sanctioned; nor do we. Another speaker said that they could manage very well with eighty years. Another advocated an application for compulsory powers; and yet another spoke with dread of "emergencies" which he suggested the Directors of the Company might foresee, but which the Council did not. Thus the subject was sent from pillar to post, until in the end the Committee's recommendation was defeated by a majority of five. In vain did the Chairman of the Committee suggest that the matter should be dealt with in such a way as to allow of its discussion "at a preliminary "meeting of the ratepayers." On the whole, therefore, the Portsmouth Corporation cannot be congratulated on their way of dealing with a question which is, undoubtedly, of great local interest. After all this delay and discussion, they should at least have ensured the consideration of the subject by those who entrust them with the management of municipal business; so that the matter might either be definitely dropped or proceeded with in a practical and business-like manner. After this collapse, they cannot reasonably expect the Directors of the Company or the shareholders to regard their negotiations with any particular degree of interest or concern. The proprietors have a fine property; let them enjoy it in peace and quietness, if the Corporation do not mean business. That, at least, should be the outcome. But, in reality, it is likely that the harrying process will be revived at intervals. Those who read between the lines of the recent discussion, and who have some experience of the workings of the municipal mind, will probably understand the drift of the vote just given. Instead of grappling with the question, the representatives of the Portsmouth ratepayers prefer to let it "slide" a little further; hoping that the Company will be wearied into further concessions, or that something will occur to enable the Local Authority to cheapen the undertaking they hanker to possess but lack the courage to buy.

Presentation to the Manager of the Newington Water-Works.—In consequence of the transfer of the Newington Water-Works to the Hull Corporation, the staff of the former is about to be disbanded. Before parting with their Manager (Mr. Huggins), however, the men presented him with an illuminated address, in which they acknowledged the consideration and kindness they had invariably received at his hands.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 461.)

THE week just closed has undoubtedly been a much brighter period for the Stock Markets than any they have recently been having. The unexpectedly large majority in favour of the repeal of the Sherman Silver Act almost revolutionized the American market; and, with the removal of this bugbear coming within measurable view of the future, other departments which had been sympathetically depressed experienced a welcome sensation of relief. Business at once became more brisk; and prices began to rally materially. As discount rates fell, and the condition of the Money Market became easier, the tendency towards buoyancy was emphasized, especially where "bears" had to buy back. The general advance received a slight, but inevitable, check when those who had got in well set out to realize profits. But nevertheless a good healthy undertone was maintained; and the general position at the close was satisfactory. The Money Market, which, as already stated, had become easier, rallied to an appreciable extent, owing to a temporary demand at the end of the month; but rates ought soon to fall. Business in the Gas Market has aggregated a moderate amount; but it was to an extraordinary degree confined to Gaslight issues—transactions in anything else being of the most restricted character. In Gaslight "A" the course of business shows nothing remarkable, beyond a continuation of the marked firmness hitherto noted; transactions day by day never ranging more than a fraction above or below 226. All the secured issues—debenture, preference, and limited—were active to a disproportionate degree, owing to the well-maintained demand for high-class securities; and they realized good prices all round, while one or two of them have advanced in price. South Metropolitans, which were absolutely untouched in the preceding week, showed only a single transaction in "B" last week—a remarkable degree of stagnation. They are all quoted higher *ex div.*; and stock appears scarce. Commercials made no sign. In the Suburban and Provincial group, some *ex div.* changes are advantageous; but beyond this, there is no salient feature. Continental Companies were quiet, firm, and unchanged. None of the other undertakings attracted notice; but Ottoman was easier. In Water, what few bargains were marked showed good firm prices all round; but nothing moved.

The daily operations were: The Gas Market opened unchanged on Monday and prices held firm all round, though Ottoman fell ¼. Business was much the same on Tuesday; the greatest activity being in Gaslight secured issues. Quotations remained as before. Transactions on Wednesday were exceedingly restricted, and again nothing moved. On Thursday, the continued request for Gaslight debentures sent the 4 per cent. up 1. On Friday a similar advance was made by the "H" 7 per cent. limited. Saturday's business was about on a par with the rest of the week; and all quotations remained unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Glasgow Corporation and the Telephones—Central Station Work in the Provinces—The Bradford Corporation and Lord Kelvin.

THE affair of the Glasgow Corporation and the telephones is a striking example of the progress of the idea of the municipalization of public services and supply undertakings, which began with water, and has now no apparent limitation. The telephone service has been developed in Glasgow, as everywhere else in the kingdom, first by private enterprise, and afterwards under Government licence, as a branch of the Postmaster General's monopoly. It has become known to the Corporation of Glasgow, however, that arrangements are pending for an agreement between the postal authorities and the National Telephone Company, which would have the effect of handing over the streets of the city to this Company for laying the underground wires required for the new metallic circuits. This news roused the Corporation to arms; and they sent last week a deputation to the Postmaster General to explain the municipal view of the matter, which is dead against permitting interference with the streets by any outsiders. And when it comes to the question of improving the telephone service, the Corporation declare that they can do this for themselves, at one-half the price at present charged by the National Company. Accordingly, the Corporation not only oppose the threatened arrangement between the Post Office and the National Company, but appeal for a licence to set up a local telephone service of their own. The Postmaster General heard what the representatives of Glasgow municipalism had to say for themselves; but in reply, he took the opportunity of denying that the telephone is municipal business—pointing out that it is a branch of the telegraph system, which is part of the business of the State. He argued that the question of local telephone service is inextricably bound up with that of trunk-lines from town to town, which must remain a national concern. On the whole, the Glasgow deputation did not gain much by their interview with the head of the Post Office. But, on the other hand, it is by no means certain that the Govern-

ment Department, if it consents to deal with the telephones without deferring to the wishes of the great municipalities, will not find itself in a false position of peculiar awkwardness.

There is no questioning the fact that a good deal of activity is being displayed at the present time by local authorities in many parts of the country in the matter of saving their Electric Lighting Orders by establishing small central stations. Many of the Orders have actually lapsed; but it is generally believed that the Board of Trade will not be hard upon the municipalities if these can show that they have been occupying the time of grace in fruitful inquiries. One result must certainly be noticed in connection with these belated proceedings under the Electric Lighting Act—they are in every instance upon a much more modest scale than would have been the case if work had been started before the smallness of the public demand for electric lighting was illustrated in the experience of the pioneer concerns. Consulting electricians everywhere have had to talk of hundreds of horse power instead of the thousands they formerly raved about; and it is pretty generally understood that there is not the remotest prospect anywhere of electric lamps taking up the increase of the gas undertaking. This means poor business for practical electricians in the future. But in the meantime, there are a good many nice little orders for electric lighting plant flying about, for those construction firms that are lucky to be in the fashion; and the money will be safe, which is a powerful consideration.

The proceedings of the Bradford Corporation, in connection with Lord Kelvin's examination of the rival schemes for the extension of the town electric lighting undertaking, have greatly interested and amused our electrical contemporaries. The worthy burgesses felt themselves completely at sea with regard to the position and prospects of this troublesome venture of theirs; and they did a wise thing in calling upon Lord Kelvin to help them to make up their minds as to what to do with it. Lord Kelvin, moreover, showed himself particularly amiable in his dealings with the puzzled Corporation. He not only looked into the source of their trouble and advised them generally, but he also granted them a long interview, at which he answered innumerable questions about all sorts of points of detail. The Committee asked him about systems, engines, cables, and an infinity of other subjects, which he met with unfailing courtesy, and satisfied with great good sense. It is quite a wonder, as one of our electrical contemporaries contemptuously remarked, that Lord Kelvin was not asked whether the engine-house door had better be painted green or brown; but if the inquiry had been addressed to his lordship, it would probably have been replied to in the same spirit as all the rest. The net result of the appeal to Lord Kelvin is that Mr. Baynes and the three-wire system of distribution triumph, and Mr. Shoolbred and the five-wire plan are rejected. This decision meets with the approval of the *Electrical Review*, which goes so far in its admiration of the three-wire system as to remark that the most successful electric lighting central station—that of the St. James's and Pall Mall Company—was opened about the same time as the Bradford station, and declares that "among other things, the three-wire system was responsible for the extraordinary success of this company." This is surely a little bit too strong. One is getting tired of seeing the St. James's Company held up to universal admiration on all occasions when electricians want a bright and particular example to show that their undertakings do not always result in financial disaster. In the present case, it is tolerably clear that the "other things," among which may be included an unequalled situation and district, were more conducive to the financial prosperity of the St. James's undertaking than the three-wire system, good as this may be. One should not push this kind of advocacy of a system too far, or it might lead unkind people to ask whether there are not instances in which neither the three-wire nor any other system of distribution has sufficed to avert disaster.

Death of the Chairman of the Hastings Gas Company.—It is with deep regret that we have to announce the death, on the 22nd ult., of Mr. Joseph Brown, the Chairman of the Hastings and St. Leonards Gas Company and of the Bexhill Gas and Water Company. He was also a Director of some other local concerns, and was the oldest member of the Hastings Town Council, in connection with which body, for many years, until twelve months ago, he occupied the position of Chairman of the Water Committee. The deceased gentleman was 67 years of age; and his death occurred rather unexpectedly, after only three or four days' illness.

Private Bill Legislation.—The work of the present session as regards Private Bills is now practically concluded, there being only three Bills awaiting the Royal Assent—one of these being the much-debated London Improvements Bill involving the question of "betterment." Of the 213 Bills (including 21 which stood suspended from last session), 154 have received the Royal Assent; three have been rejected by the Commons and two by the Lords; while the remainder have been withdrawn or otherwise not proceeded with. To these must be added a large number of Provisional Order Confirmation Bills which involve the fixing of maximum rates on canals, extensions of gas and water works, the carrying out of sewage works, and other matters which have first to receive the approval of the respective Government Departments.

THE UTILIZATION OF ENERGY.

PERIODICAL stock-taking is as necessary an operation in science and the industrial arts as it is in commercial undertakings. Workers in science and industries are commonly so engrossed upon the study and elaboration of details, in this age of specialists, that it is highly essential for them to be occasionally called to listen to somebody who is able to tell them precisely how far they have gone along the high road of progress, where they stand at the moment, and what is the prospect that lies before them. This service is best performed by lecturers duly appointed and accredited by our leading scientific institutions; and we have repeatedly expressed the thanks of the gas industry to such bodies as the Society of Arts for what the Society has done in this way for the industry. The Royal Institution discharges a similar function, while acting upon different lines; and we now propose to draw our readers' attention to a highly suggestive lecture delivered in Albemarle Street by Professor B. W. Kennedy on "Possible and Impossible Economies in the Utilization of Energy," containing many valuable observations upon a subject of great interest to gas engineers in particular, and of supreme importance to the community generally.

The economy of energy, as Professor Kennedy put it, may mean wealth and prosperity to a nation, while waste in energy may result in diminished commerce and in general depression. The older a community grows, it may also be said, the more essential becomes the economical employment of its forces of every kind, if it is to keep up in the secular race with communities extravagantly spending the energies of their youth. The world requires energy for an infinite number of purposes—the lighting of lamps, the driving of factories, the transporting of commodities, and so forth; and there is plenty to be had, at a price, for all these services. In entering upon the consideration of the means of procuring and utilizing energy, it is advisable to start, as Professor Kennedy does, from the datum of the impossible, which is perpetual motion, or, which is the same thing, the attempt to get more out of something than it contains. This proviso leads the lecturer to the statement of three fundamental facts, which are as follows: (1) Every transformation of energy is accompanied by some waste of energy; (2) every transformation occurs in absolute accordance with certain phenomena which reproduce themselves so exactly that they have come to be called physical laws; and (3) all the quantities which can appear in every transformation are as exactly measurable, and have been as exactly measured, as could be the temperature of a room or the breadth of the street outside. There is no room in these cases for guessing, or for dealing in mere wordy generalities or speculations. A man who says he is going to produce 25s. out of a sovereign would be laughed at; but he is not talking any greater nonsense than the man who should propose, for instance, to double the present efficiency of a pound of coal.

Professor Kennedy remarks on his second axiom, repeated above, that he knows he is treading upon difficult and delicate ground, seeing that there are many people who would object that all the laws are not known, that all the phenomena even are not known, and that discoveries may yet be made which will turn everything upside down at a stroke. He admits that the best-informed among us really know very little about things; but he points out that this objection to saying anything is impossible on account of our ignorance of what is possible is seldom thrown out by those who know most, even although, among other things, they well know their own ignorance. It seems always to be urged most strongly by those who know least. "To the latter—to the good folk who dabble in physics and chemistry, and patents and syndicates—it is always possible to conceive that some new law or force, or source of energy, or what not, will rise Minerva-like, fully equipped for use in the universe, and particularly equipped for making their individual fortunes out of a casual suggestion or a random experiment." How often have we seen this observation exemplified by the promoters of new gas schemes!

The lecturer wisely said, in continuation of this line of thought, that the superstructure in physical knowledge is much more solid than its foundations. "The position is indefensible structurally and ethically; but it actually appears to represent the facts. Our knowledge of the ultimate constitution of matter, and particularly of the ultimate constitution of 'not-matter,' cannot be said to be accurate as yet." One step from what is known about matter brings us to the verge of the Infinite Unknown. But it does not follow that our knowledge, so far as it goes, is not to be relied upon for working purposes. The combustion of coal is an example. The composition and combustible value of the constituents of coal are so well established that the actual heat-energy in foot-pounds which could be generated by the perfect combustion of any given 100 tons of coal lying in a yard can be ascertained within 1 or 2 per cent. "Our knowledge in this respect is quite independent of our ignorance of the ultimate nature of the coal or the combustion. Assume, if you like, that hydrogen, like Homer, is not really hydrogen, but quite another element of the same name; assume carbon to be an allotropic form of oxygen; assume, if you please, that atoms are creatures of two dimensions, in series, connected by a little wire—none of these assumptions, although they would be fundamental enough, will in any way

invalidate our conclusions, or will enable us to get a single foot-pound more of energy out of a ton of coal than we already know we can obtain."

Professor Kennedy proceeded to show how far the efficiency of coal combustion has been carried in steam generation. Calling the potential energy of a given weight of coal 100, and setting up on a horizontal line two parallel perpendiculars divided into 100 equal parts, he marked off on the left-hand scale the proportions accounted for under the heads of steam, imperfect combustion, chimney draught, and radiation; and on the right-hand scale the same proportions as resulting from thoroughly good working. Thus, in the former case, the amount of heat taken up by the steam would be only 50 per cent.; whereas in the latter it might run as high as 80 per cent. The remaining 20 per cent. in the latter case represents the possibility of further saving. Some of it must go in heating the chimney gases; being the consideration paid for the draught of the chimney. Loss by radiation is also inevitable. The conclusion drawn is that no very astounding increase of boiler efficiency over the actual best performance is to be expected. Consequently, when any enthusiastic schemer declares his ability to make one pound of coal go as far as two pounds have gone before, one of two things is certain—either he is mistaken, or else his standard of comparison has been unfortunately chosen. The same lesson applies to the carbonization of coal in gas manufacture. It is easy to show a vast improvement, if the datum of comparison is only fixed arbitrarily low enough down. "Surely all discoverers must start from the very fore-front of their predecessors' position." They should do this; but very often they do not. This, as Professor Kennedy says, sounds absurd enough; but it is quite true that "hundreds of thousands of pounds have been thrown away on elaborate schemes which, at best, could do no more than bring bad and careless practice up to a level passed every day in places where care and common sense have been expended on the same matter. Plenty of room exists for raising the general average efficiency of boiler (? carbonizing) work; for, if the average working all over the country were brought up to the standard of the best, there would probably be one-third less coal used every year than is now actually burnt. The possible economy is truly not unimportant; but I fear it can only be brought about by methods too commonplace to please humanity, who are just as ready to call for signs and miracles as they were 2000 years ago." This is solid wisdom.

The lecturer then proceeds to deal with the utilization of steam; and, at the outset, he confesses that this is a different matter from its generation, inasmuch as the maximum theoretical efficiency is far inferior—not exceeding, indeed, 25 per cent. as compared with 100 per cent. in the latter case. In the very great majority of instances, the mechanical energy which we utilize is originally obtained from the heat of combustion, transferred to some liquid or gaseous body, and by it made to cause certain parts in a machine to move and to do mechanical work. The actual cycle of physical processes, isothermal, adiabatic, iso-dynamic or what not, which the heated steam or air or gas may go through in doing its work, is often very complicated—so much so that it is sometimes a matter of considerable difficulty to say beforehand exactly what the maximum theoretical efficiency is. We always know, however, two things about it—first, that it is always far less than 100 per cent.; secondly, that it cannot exceed, and in all practical cases must fall considerably short of, a certain known limiting value much less than 100 per cent. This value is the well-known function of the temperature, which is written $\frac{T_1-T_2}{T_1}$, in which T_1 stands for the highest temperature measured above absolute zero at which the working fluid receives heat. T_2 stands for the lowest temperature at which the fluid parts with its heat. The difference between the two temperatures represents the working range of the fluid. The ratio of efficiency is always much less than unity. In the case of a modern steam-engine, it is often about 30 per cent.; and with a gas-engine, it may be from 60 to 65 per cent.

It is certain that no steam-engine in existence works in a cycle which would give out this efficiency; but it is equally certain that by no changes or inventions whatsoever can an engine be made to work in a cycle which shall have a higher efficiency. In any actual possible steam-engine, the process differs so much from the ideal cycle, that not more than from 20 to 25 per cent. could be attained, even if the process were carried out perfectly. But there are very great difficulties in the way of carrying out even this imperfect process at all completely; and so it comes about that in the last result "only from 5 to perhaps 15 per cent. of the whole heat of the steam is ever turned into work—sometimes a little more, but more often a little less." Ninety per cent. of energy wasted seems to leave a glorious field for improvement; but, unhappily, most of it is inaccessible. The reason for this lies in the impossibility of getting away from the bounds set by the function of the temperature. It is not difficult to see how this matter comes out practically. In all heat-engines as at present made, some fluid or other is used as a vehicle for the transformation of heat into work. It may be coal gas, or producer gas, steam, air, or the vapour of ether or ammonia. With steam, the difference of working temperatures is between 60° and 400° Fahr., or thereabouts. Quite at the other end of the scale come gas-engines, in which the combustion occurs inside the engine itself, and not in a furnace, and where the highest temperature may attain 2000° Fahr. All these various working fluids are subject to the same physical laws and limitations. Nature will not be persuaded, even by the most seductively-worded prospectus, to make an exception in favour of anybody's patented material.

(To be continued.)

THE WATER UNDERTAKINGS OF THE GLASGOW AND EDINBURGH MUNICIPALITIES.

In the Sanitary Engineering Section of the British Institute of Public Health, whose annual congress was recently held in Edinburgh, two papers of very considerable interest were read and discussed. Mr. J. M. Gale dealt with the Loch Katrine Water-Works; and Mr. A. Leslie read a paper on the Edinburgh Water-Works. The facts and figures laid before the congress by these gentlemen furnish an apt corollary to the remarks we made last week in connection with the Municipal Water-Works of Sheffield. In the last-mentioned town, as was pointed out, the Municipality are engaged upon a stupendous development of the local water-works system; and it will be seen from the papers referred to (of which an abstract was given in the Journal for Aug. 22), that north of the Tweed also water-works enterprise has been taken in hand upon a correspondingly extensive scale. In relation to the Loch Katrine works, from which the water supply is drawn for the City of Glasgow, Mr. Gale mentioned the significant fact, that when in 1854 the scheme was first discussed, it was considered to err largely on the side of the superfluous. Yet, after an interval of 25 years, it became apparent that, even in its full measure, the contemplated supply would be quite inadequate to the requirements of Glasgow. In other words, the estimates as regards increase of population and quantity of water to be consumed per head, had fallen far short of the actual requirements which the Glasgow authorities were called upon to meet. Hence it was that in 1875 an Act was obtained for the purpose of authorizing a large extension of the works; such extension comprising another aqueduct from Loch Katrine, increased storeage, extra service reservoirs, and additional mains. The net result meant little less than a duplication of the works originally authorized. It was deemed necessary, indeed, to provide prospectively for an ultimate supply of not less than 100 million gallons of water a day; and for the new works, including the service reservoirs, the parliamentary estimate was £1,150,000. Happily, the promoters obtained facilities for spreading the execution of the works over a long period of time—in fact, no date was fixed by the Act for their final completion. At present one-third of the new aqueduct is completed and in use; and the supply has been increased by 4½ million gallons per day. Eighteen months hence two further instalments of the entire work will have been finished; and the enterprise in its entirety will be carried into effect as circumstances may hereafter require. The great work of raising the level of Loch Katrine is not likely to be entered upon until the water consumption reaches 50 million gallons a day.

Turning to Edinburgh, we find, as might be expected, a record of the development of a water-works system which, though important, is not on so gigantic a scale as that of Glasgow. One feature in Mr. Leslie's paper gave rise to considerable discussion—viz., the statement that the consumption of water in Edinburgh is now 37 gallons per head per day, against a former record of 42 gallons. This economy has been effected by the diligent execution of repairs throughout the distributing plant, and by carefully checking waste. Still the average supply represents a high figure; though it was remarked that, while in Edinburgh the average consumption is 37 gallons per head per day, in Glasgow it amounts to no less than 50 gallons per head. In either case, the supply is considerably in advance of the average in the large towns of England, where it varies from 20 gallons and upwards—giving an average quantity of 28 gallons per head per day. Of course, as was pointed out by Mr. Gale, in reply to the various speakers, the circumstances vary in the different towns. The supply necessarily depends to a large extent on the development of the water-closet system, and on the introduction of hot-water baths in private houses, together, of course, with the varied requirements of different localities for trade purposes. A partial explanation of the excessive consumption in Scotland is to be found in the fact that the people live in flats; and the water, having to be supplied to each flat, results in very considerable leakage.

Death of Mr. W. Roberts.—The death is announced, at the age of 73, of Mr. William Roberts, Reservoir Superintendent of the Sheffield Corporation Water Department, with which he had been connected for about forty years.

Presentation to Mr. R. J. M'Connell, of Belfast.—The members of the Belfast City and District Water Commissioners have recognized the great assistance which their Chairman (Mr. R. J. M'Connell, J.P.) rendered in the carrying through of difficult negotiations connected with their new Act, which obviated a good deal of expensive opposition, by presenting him with a massive 26-inch Queen Anne salver, containing 150 oz. of silver.

NOTES.

The Temperature of Steam from Salt Solutions.

Some short time ago, it was suggested by Lord Rayleigh that the efficiency of the steam-engine might conceivably be increased by adding some salt to the water in the boiler, which should have the effect of raising the boiling-point of the solution. The idea sought to be conveyed was that the initial temperature of the working fluid might be thereby increased; thus providing for a larger range and a greater fall of temperature between the boiler and the condenser. Certain critics objected to this proposition that to raise the boiling-point of an aqueous solution does not necessarily imply a corresponding elevation of the temperature of the evolved vapour, which is simply that of water, and must accordingly possess only the temperature corresponding to the pressure. A number of experiments to determine the temperature of the steam arising from a boiling salt solution have been made from time to time; but the results have been of a conflicting character. The difficulty of arriving at trustworthy results in this class of experiments consists in the circumstance that, while the walls of the steam-chamber must be at a temperature higher than that of boiling water, and yet below the temperature of the solution, a sufficient quantity of steam must be evolved to ensure that these walls shall not exercise any appreciable cooling effect upon it. These *desiderata* are claimed to be all satisfied by an arrangement devised by Professor Sakurai, of the College of Science of the Imperial Japanese University, by the aid of which it has been determined that the temperature of the steam escaping from boiling aqueous solutions of such salts as calcium chloride, sodium nitrate, and potassium nitrate, is exactly the same as that of the solution itself. This is a corroboration of Lord Rayleigh; but, whether the fact is of any material service to mechanical engineers remains to be seen.

Electric Heating under Water.

A method of heating, believed by the inventors to contain the possibility of attaining the unheard-of temperature of 8000° Cent., is deserving of notice, especially as the process presents the apparent inconsistency of being worked under water. It is now being exhibited at Chicago by the agents for the patentees, Messrs. Lagrange and Hoho, of Brussels. Shortly described, it consists in raising a piece of metal to a white heat or a melting temperature in a pail of water. The process can be experimentally shown as follows: An ordinary wooden pail is three parts filled with water slightly acidulated, into which a lead plate about 9 inches wide and 16 inches long dips to the bottom, and forms the positive terminal of a dynamo such as is used for incandescent lighting, giving a current of 150 ampères at 110 volts. The article to be heated is connected with the negative pole of the dynamo, and is simply dipped into the water. It immediately becomes heated; and if of iron, rapidly attains a welding temperature. So rapid is the effect, that neither the water nor the portion of the metal not wetted become very warm. Wrought iron and even steel actually melt if held long enough under the water. A piece of carbon so treated becomes amorphous, showing that a temperature of 4000° Cent. has been attained. There are various theories to account for the phenomenon; but it is believed to be an example of arc heating through hydrogen gas, derived from decomposition of the water. A flame of burning hydrogen appears round the metal on the surface of the water. The heating is at first confined to a very thin layer of the surface of the metal, though it will spread if the action is long continued.

The Iron Colouration of Natural Waters.

Mr. Frederick S. Hollis, of Boston, Massachusetts, recently made some interesting investigations in regard to the colouration of natural waters, which not only throw a good deal of light upon this subject, but have some bearing upon the problem of the origin of pond and log iron ore. The colour of natural waters is usually, and with reason, referred to the presence of organic matters; but the results of Mr. Hollis's observations upon the colouring of water taken from deep ponds indicate that it may be partly due to the presence of iron and manganese salts. It was ascertained that the colour of surface water is practically independent of the iron contained in it, and is mainly due to the organic matter. In the case of water taken from the bottom of deep ponds, however, it was found that below 40 feet soundings the water was completely deoxidized, showing the stagnation of the layers where the influence of the wind ceased to be felt. Water from the depths showed a large proportion of free ammonia and of oxidizable carbonaceous matter in solution; and had an acrid, disagreeable odour, due to the presence of a considerable amount of organic matter undergoing decomposition. The deeper the water, the stronger its colour, most of which is lost on exposure to sunlight; the colouring matter settling as a precipitate or being removable by filtration. The iron which colours the water is originally derived from the decomposing vegetation and the soil of the bottom of the ponds. The organic matter in these deep ponds tends to its ultimate form of carbonic acid; and if there is a lack of atmospheric oxygen to support this process of decomposition, the organic matter takes it from any available ferric oxide, thus converting the iron into a soluble ferrous salt, which is carried off by the water that drains the land. When such water enters a pond where the surface is well aërated by the wind, the iron is re-oxidized to ferric hydrate and precipitates. This falls of its own weight to the bottom, where it yields up its oxygen for the further oxidation of the organic matter which is there undergoing oxidation. The iron is thus nearly all reduced to the ferrous or colourless form, so long as the water containing it is not exposed to the air. Whenever this happens, the iron settles out as ferric hydrate, leaving the supernatant water colourless; but the iron itself deposits at the bottom of the pond, where it may be found as "bog ore."

COMMUNICATED ARTICLE.

SMALL GAS UNDERTAKINGS AND DIFFERENTIAL PRICES.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

A "small" gas undertaking, in gas engineering parlance, is something more than merely a concern that does a limited extent of business. It is further understood as being placed at a disadvantage by reason of its smallness, inasmuch as it cannot make gas so cheaply as its larger neighbours. There is a limit, which may be roughly taken at an output of 100 millions per annum, beyond which it appears that any further increase in productive capacity is not attended with additional economy in working. At any rate, undertakings of this size are able to make and sell gas as cheaply, all things being considered, as a gas-works of the first magnitude. In the South of England, the total expense involved in delivering gas of the usual quality at the meter of the consumer may, for the purpose of argument, be taken at about 1s. 8d. per 1000 cubic feet; and to this must be added, in order to give an average dividend on the whole of the capital of 6 to 7 per cent., which is about the usual rate, 10d. to 1s. per 1000 cubic feet. This brings the selling price of gas, under the best conditions, to 2s. 6d. In the North of England, and where gas coal is cheaper, the working expenses will run considerably less. But it will be sufficient for the present purpose to call 2s. 6d. the "economic limit."

The relations of any one gas undertaking to its consumers will be largely affected by its position in respect to the economic limit. Many of them are fixed at a long distance from it by special local circumstances, which no one can control; the most general being a limited demand for gas, which places the annual output at something far below the 100 millions. Some that are right in the matter of size may be loaded with capital—the results of extravagant or unskilful expenditure in years gone by, of heavy legal expenses incurred in fighting opposition or in amalgamations, of considerations for goodwill and such-like extraordinary charges, or of loss of business—rendering a charge of 1s. per 1000 cubic feet insufficient to afford a reasonable profit for the shareholders. Or they may perhaps be geographically situated in a locality that necessitates heavy cost for carriage, or other items that go to largely enhance the working expenses. So there are several causes, apart from the question of magnitude, that may force up the selling price of gas to 3s., 4s., or even 5s. per 1000 cubic feet, and that with a less percentage profit, and not a greater, than in places where the gas is cheaper. Under the most favourable circumstances, it will be found that, with a sale of only 5 to 10 million cubic feet of gas per annum, the working expenses will run to another 1s., and the sum required for interest to nearly as much; bringing the selling price to something like 1s. 6d. or 2s. more than the economic limit. So that, whereas the undertaking producing 100 millions, and free from the drawbacks just mentioned, may sell gas at about 2s. 6d. per 1000 cubic feet, the other cannot do so under 4s. or 4s. 6d. In the first case, the directors and manager are exempt from, and have no knowledge of, a great deal of trouble and worry that has to be encountered in the second. They have no reason to fear threats of competition, and the extension in the use of gas for purposes other than lighting takes care of itself, leaving them nothing to do but to keep up with it. A speaker at a recent meeting of American gas managers lamented that he had put down plant for the purpose of lighting the public streets by means of electricity, but at the last moment had lost the contract. The large gas undertaking rarely meets with anything like this; but small ones know what it is to provide extensions of plant such as a long length of main, in the reasonable hope of securing an important addition of business, and to have their hopes shattered, and an extent of plant that forms no inconsiderable part of the whole left idle on their hands. They know what it is for a large factory, which has hitherto taken perhaps 20 per cent. or so of the whole make, to be shut up and left to fall to ruin, burying a respectable portion of their own profits in the process. They knew what it is, in a residential district, to have 50 per cent. of the houses in a street standing empty for months or even years together. The large undertaking is fairly sure of a rising market; but the small one is not so.

In addition to the above, there is another consideration that is of great importance in connection with this question as applied to small undertakings. In their case, a large proportion of the plant must necessarily be in excess as regards productive capacity. A 10 or 20 million plant can be duplicated at a surprisingly low cost, if it has been skilfully laid out in the

first place in view of such enlargement; and the difference between increasing it 50 per cent., or doubling it, is a mere trifle. So that, if a small concern finds itself in possession of a badly arranged, obsolete, or worn-out plant, or if, from any other causes, the question of extension or renewal is forced upon it, the advisability of doing the thing on a good substantial scale is evident, and under any circumstances, a reserve is provided that would be unheard-of in large works. The giant can run easily a year or two ahead of his requirements; but the pigmy must move in ten-year jumps. In the large works, it is easy to provide 10 per cent. increments to the plant, with the exception of such a thing as a big purchase of land now and then. In the small works the addition, if made at all, is one of 50 per cent. or so; and the management has to face such questions as whether it is wise to limit the capacity to 15 millions, when another £100 or so would make it equal to 20 millions.

It will be observed that the economic limit, though expressed in a specific figure, is a variable quantity, not only as regards one undertaking compared with another, but that it fluctuates from year to year, according to the prices of material and labour, and to the state of skill in engineering for the time being. In fact, like the place where the rainbow rests, it recedes from the pursuer, and is never actually reached; and like the cissoid curve, it has no finality. Although the goal of every gas manager, those who have practically attained it for the time being, have not the same incentive to work in its direction, as those who are a long way off. New business, in the first instance, is no help towards it; in the second, the greatest aid that can be expected. Here we have the root of the great difference between large and small undertakings, in respect to the present question. In the large way, additional business simply means a *pro ratâ* increase of working expenses and interest both in the lump; in the small way, it means increase of capital in less proportion, and the opening up of roads for economy in several directions as regards working expenses. The manager of a small works having (say) 30 to 60 per cent. reserve capacity knows that anything like an important step in the way of securing its employment, is also a move nearer to the far-distant economic limit.

Only a short time since, the writer had occasion to investigate an application from a possible user of a large gas-engine. The undertaking was only a small one, doing about 6 millions per annum; but the plant had just been enlarged sufficiently to deal with 9 or 10 millions. The present net cost of the gas was 2s. 9d.; and the charge for a 5 per cent. dividend 1s. 4d.—necessitating a selling price of 4s. 2d. per 1000 cubic feet. In a large-sized town, the thing would be simple enough. There would be a plain application for the service to be laid on, and the meter would be supplied. But in this case the applicant stated that he should not have the engine at all, unless a large discount could be allowed. The question was, Could any discount be offered; and, if so, how much? It goes without saying that the company would have been only too pleased to secure the customer at the regular rates. The advocates of uniform all-round prices could do nothing in this case but refuse the application. The applicant would have laughed at an offer of a 5 or 7½ per cent. reduction; and the most sanguine anticipations could not realize the possibility of a time when the price might, by repeated general reductions, come down to his views. There was the plain fact that the working expenses and the interest would both be lowered by taking him on. The only objection was the principle of equal charge for profits on each 1000 cubic feet of gas made; and this principle is one, as I have already remarked, upon which something may be said on both sides. Would it have been right or reasonable to refuse to give the consumers a real benefit for fear of doing them an abstract injustice? For the addition of this large consumer would be a real benefit to the others, as reducing the working expenses, contributing to the profits, and thus hastening the day when a reduction could be made. Looking at these facts, an all-round scale of discounts, according to the quantity consumed, ranging up to 20 per cent., was decided upon, and the customer was secured. In considering this step from a small consumers' point of view, we have first to determine what constitutes injustice to a consumer. According to Mr. Livesey's views, this is a flagrant instance of such. If one customer has gas at 3s.4d. per 1000 cubic feet, he would say that another is equally entitled to it at that price. But most consumers would look at the question from the practical £ *s. d.* view, rather than from a theoretical or speculative one. Their idea of injustice would be a rise in the price. So long as the profits are not encroached on, either in the form of additional dividends, or of excessive discounts due to selling gas at an actual loss, they suffer no real injury, but on the contrary, will receive, sooner or later, a real benefit in the form of a reduction of price.

There is a great deal of difference in the minds of gas engineers as to what constitutes a "small" and a "large" consumer. The small customer of one town may be the large one of another. Some talk of "small" consumers using 10,000 or 12,000 cubic feet of gas per annum; others put it at half that quantity; and, in many parts of the country, the idea conveyed by the term would be about 2000 cubic feet per annum. But it is only in the very small undertakings that the large consumer shines forth in his glory. In the large city he is only one among the rest; but, in the small country town, he tells the manager and the directors what they ought to do. To the small undertaking a user of only 10,000 cubic feet per annum is an important customer. He takes perhaps 1-500th of the whole output. Apply the proportion to the largest gas undertaking in the world; and we arive at about 40 millions. A possible consumer of 40 millions, or even of 4 millions, per annum would be considered worthy of attention. In the large works, no consumer attains such proportions as to be able to influence the fortunes of the concern. But country gas undertakings have to do with individuals who take 10, 20, or 30 per cent., or even a larger proportion of the total production. The entrance of such a customer may double the profits, or his exit may be attended with their entire disappearance. To use an Irishism, the consumers of a small works are all large ones, and those of a large undertaking are all small ones, in respect to their influence on the concern as a whole. Here I would like to say a word about that unfortunate undertaking that figures as the "awful example" in Mr. Livesey's paper, in consequence of having taken the step of offering 1s. per 1000 cubic feet discount on increased consumption. I do not know the name or any other particulars of the company, but can quite conceive, from actual experience of the affairs of small undertakings, the possibility of circumstances being such as to render the offer a judicious step in the interests of all concerned. I take it the directors see there is available business which cannot be secured without a sacrifice. Whether or not they have offered too much, is a matter that can be proved from their accounts. It is certainly a strong remedy; but for some things, strong remedies are the only ones. Assume a large surplus of productive and distributing plant, and a high charge (perhaps about 2s. per 1000 cubic feet) for profit, and 1s. reduction is not too much. There will still remain 1s., and also economies in working expenses, to be divided between the consumers and the shareholders; and the only way in which a real practical injustice would be done would be by either one party securing more than the additional profits, leaving a deficit for the other to make up—in other words, by a reduction of profits, or by an increase in the price of gas. The question has always been complicated, from the earliest times, by a certain sentimentality; but it would be difficult to produce actual evidence of any person suffering inconvenience or trouble by reason of having to pay another 6d. or so per 1000 cubic feet for his gas. The only trouble he takes is not to waste so much as when it was cheaper. But it must be observed that the poorest is not necessarily the smallest consumer; nor does it follow that the latter is deserving of special consideration on account of his poverty.

The object of this and a previous communication has been to show that it is only the large or the fortunate class of gas undertakings that can afford to stand out for uniform rates; and that, in the case of those who must necessarily sell at prices considerably above the "economic limit," a judicious system of discounts to large consumers is really the most advantageous for all concerned, whether shareholders or consumers, because it tends to add to the safety and prosperity of the concern on the one hand, and to the securing of cheap gas on the other. If the uniform rate is necessarily high, the day consumption and use of gas for purposes other than lighting must as necessarily be small; and any attempt to lower the charge all round to a degree sufficient to secure that line of business would mean a sacrifice of profits for a few years, which is a contingency few shareholders would care to face.

The Forthcoming Meeting of the British Association.—The arrival of September brings with it thoughts of the meeting of the British Association, which will be held this year at Nottingham. It is expected that there will be an important discussion on bacteriological work and the chemical problems connected with it, which will be opened by Professor Percy Frankland; and another on explosions in coal mines, with special reference to the dust theory, opened by Professor Harold B. Dixon.

A Large Syphon.—In a recent number of the *Engineering Record* there was an illustrated description of a rather remarkable syphon which is used on the works of the New York City Suburban Water Company, which supplies the city of Mount Vernon. The syphon is 925 feet in length, and has a maximum lift of 23 feet, with a difference in water-level at the intake and outlet of only 2 feet. The construction was carried out last summer to afford an additional supply to the Hutchinson River from an ice pond near the river. The water flows through an open ditch until the depth of cut becomes prohibitive; and it then enters the syphon, which is constructed of 12-inch pipe. The interesting feature of the syphon is the air chamber, which is merely a length of pipe and an air-cock attached to a three-way branch. The pipe used was rather poor; and the work of jointing had to be done so rapidly that the leakage is probably considerable. The charging is done from a pipe of the New Rochelle Water Company, which passes above the syphon at its highest point, and can be reached by a manhole. It takes 5½ hours to fill the empty pipe; but if charged every six hours, it requires only 15 minutes each time. The discharge from the pipe is about the same as that from a pipe of the same length working under a head equal to the difference in level between the water at the two ends. Experience has shown that the air chamber is too small; so the Company now intend to build a larger one.

TECHNICAL RECORD.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

For the first time in its history, this Institution has held a meeting extending over part of two days. On Friday last a considerable number of the members paid a visit to Nottingham—the home of the President, Mr. W. R. Chester—and the proceedings were continued over Saturday. Most of the party from the Manchester district travelled together by Midland train from that city on Friday afternoon, and reached their destination about six o'clock. Later on, accompanied by the President, they visited the Castle Museum and Art Gallery, and the curious dungeons and subterranean passages in connection with that historical site. Then they went to the Natural History Museum, at University College, to inspect, in particular, the installation of lighting and ventilating by gas recently designed and applied by Mr. Chester. The members were met at the museum by Mr. J. W. Carr, M.A., the Curator and Natural History Professor, and spent a very pleasant time at the place. The lamps with which the museum is lighted are of the Wenham type; and for the purposes of ventilation, horizontal tubes are laid above the ceiling from one building to the other. Into these, the products of combustion pass, together with a large quantity of vitiated air from the rooms; and these are afterwards carried into vertical shafts through the roof, and are thus dissipated into the atmosphere. This system of lighting and ventilating is also applied to the Free Library of University College, where formerly difficulty was experienced in regard to ventilation. The result in both cases is highly satisfactory; and, however crowded the rooms may now be, the atmosphere is not felt to be oppressive.

Saturday morning's programme commenced with a visit to the subways under King Street and Queen Street, designed and recently carried out by Mr. Arthur Brown, M.Inst.C.E., the Borough Engineer. These subways have been prepared for the reception of the sewers, gas and water pipes, telegraph and telephone wires, and the cables for electric lighting. They run under the footways, with suitable branch connections to the houses on either side. They are roomy, well-ventilated, and approached by manholes at suitable distances. The arrangement is designed to enable the different departments of the Corporation to get at any pipe or connection without disturbing the pavement or roadway, and without interference with other pipes; and this purpose they admirably serve.

The rest of the day was occupied in visits to the gas-works at Eastcroft and Basford and the chemical works at Giltbrook. About an hour and a half was devoted to an examination of the alterations and extensions of the works at Eastcroft, which are in a very interesting state, as will appear from Mr. Chester's remarks given below. A series of plans was exhibited in the store-room over the new engine-house; and from these, and the works in progress, the members derived much information.

Waggonettes afterwards conveyed the party to the extensive works at Basford. In connection with the new sulphate plant at these works, a series of settling tanks have been arranged for the reception and treatment of the waste liquor from the sulphate of ammonia stills. In these the solid refuse is deposited, and the purified liquor is then discharged into the sewers. Thus the cost of evaporating the liquid into steam is saved. The retort-house, in which the new regenerative furnaces are being erected, is of exceptional length, and has a capacity equal to forty-eight beds. As to the coke breaking and washing arrangement (also referred to later on), it may be interesting to state that the water is pumped from a well on the works, and after being used is allowed to run to waste. The consumption of water is large, but the supply is abundant and cheap. In the washing boxes the necessary agitation of the water and material is produced by means of an air-blast. The fine refuse is used on the works for steam-raising purposes. In reference to the experimental plant, it may be noted that this is capable of dealing with the gas from one of the beds of retorts, and is a complete gas-works in miniature. Its use for coal-testing purposes is in an ordinary way extended over three days; the quantity of coal tested being about 20 tons. Great interest was also taken in the apparatus in the meter-house for registering the contents of the different holders. This is contrived by means of a reservoir of glycerine on the top of each holder, communicating by means of a tube with the Bourdon gauges in the meter-house. The gauges are regulated to the height and capacity of the different holders with which they are connected; and the quantity of gas in store can thus be seen at a glance. When passing the purifier-house, Mr. Chester directed the attention of the party to the evidence which yet remains (in cracks and slight displacements of the building) of the serious effects of the explosion which occurred in the tar-well, as described in the paper read by him before the Institution at the meeting in November last. Mr. Chester said that, since the explosion, he had endeavoured to guard against a similar inexplicable occurrence by carrying the sealed ventilation pipes right to the bottom of the tanks; and he had also provided vents for the gases held in solution in the tar, in order that it might be separated previous to entering the tanks. He had also closed the tanks with sealed manholes.

On the conclusion of the tour of the works, the party were photographed in a group; and they were afterwards entertained by the Corporation to luncheon in a marquee erected on a portion of the land which is so generously provided for future extensions. Mr. Alderman Ford, the Vice-Chairman of the Gas Committee, presided (in the absence through indisposition of Mr. Alderman Barber, the Chairman of the Committee). Mr. Joseph Bright, the Sheriff of Nottingham, and Sir Samuel G. Johnson, the Town Clerk, were also of the company. Mr. Thomas Newbigging proposed "The Continued Prosperity of the Gas Undertaking of the Corporation of Nottingham." He referred to the meeting of the British Association of Gas Managers that was held at Nottingham nearly thirty years ago, when, under the guidance of Mr. Thomas Hawksley, then Engineer of the works, they visited Basford and saw much at the works which excited their admiration. Since that time wonderful progress had been made; and the consumption of gas gas in the Nottingham district of supply had since increased 400 per cent. The Chairman responded to the toast, and proposed "Prosperity to the Manchester District Institution of Gas Engineers." Mr. Chester, whose name was coupled with this toast, replied. Mr. T. Duxbury, next gave "Prosperity to the Town and Trade of Nottingham," a toast to which the Sheriff and the Town Clerk replied in felicitous terms.

A few minutes sufficed for the disposal of the formal business. The minutes of the last meeting were taken as read; and afterwards Mr. E. Jones, Manager of the New Mills Gas-Works, and Mr. James Bailey, Manager of the Middlewich Gas-Works, were elected members of the Institution. On the motion of the President, seconded by Mr. J. Braddock, of Radcliffe, a vote of thanks was passed to the Corporation for their hospitality.

A drive of about eight miles took the party to the Giltbrook Chemical Works; and the members spent some time in viewing the arrangements at these works. They afterwards drove back to Nottingham, where they had tea together at the George Hotel, and then left for home. The weather throughout was beautifully fine; and the programme—arranged by the President, the Senior Vice-President (Mr. Braddock) and Mr. S. S. Mellor, the Hon. Secretary—was carried out most satisfactorily.

In connection with the meeting, Mr. Chester had prepared the following interesting particulars as to the gas supply of Nottingham:—

The gas supply to the town of Nottingham (at that time boasting a population of about 40,000 inhabitants) was inaugurated in 1818, in which year a number of its enterprising citizens banded themselves into a Company, and obtained from Parliament an Act entitled, "An Act for Lighting with Gas the Town and County of the Town of Nottingham." The Company commenced under the title of "The Nottingham Gas Light and Coke Company;" and they were empowered to manufacture "inflammable air, coke, oil, tar, pitch, asphaltum, ammoniacal liquor, and essential oil, from coal, and to lay pipes for the purpose of the better lighting of the streets, squares, and market-places, and for the lighting of private houses, public buildings, and market-places within the said town and county of the town of Nottingham." For this purpose, the Company were empowered to raise capital stock to the amount of £16,000 in £50 shares, and to raise a further sum of £5000 on loan—the price charged for gas being 12s. per 1000 cubic feet. The profits on the original stock were to be limited to 10 per cent. per annum.

The Company were incorporated in 1842; and further powers were then obtained to raise their capital stock to £40,000, and the loan capital to £13,000. The dividends payable on the new stock were not to exceed 10 per cent. per annum. But should the profits exceed this, they were to be set aside for contingencies, to the amount of £4000; and then future excesses were to be absorbed in the reduction of the price of gas.

In 1849, the Company were in Parliament again, for a further extension of powers—to increase their capital stock to £85,000, and the loan capital to £25,000, on the same terms as to dividends as before. But this time the auction clauses were introduced; and Parliament stipulated that all new stock issued should be sold by public auction; and the premium realized from its sale was to form part of the new capital, but to bear no dividend.

In 1853, the previous Acts were repealed, and a new Act was obtained, entitling the Company to raise their capital stock to £200,000, and the loan to £40,000. The whole of the capital for the future was to be limited to a 5 per cent. dividend; and the new shares were to be sold by auction. The premium realized was to be used for capital purposes, but not to be entitled to dividend.

The Company were again in Parliament in 1858; and they then obtained powers to raise their capital to £400,000. The new shares were to bear the same rate of dividend, and to be sold by auction as issued—the premium realized to bear no profit as before.

The principle of the sliding-scale was here introduced for the first time; the Company being empowered to receive an increased dividend of 10s. per cent. when the price of gas was lower than the standard schedule. This ranged from 3s. 1½d. to 3s. 6½d. per 1000 cubic feet according to consumption, ranging from 25,000 to 200,000 cubic feet per quarter. The illuminating power of the gas was also fixed; and for the future it had to be equal to 12 sperm candles.

In 1864, power was obtained to extend the district of supply; and the average meter system was introduced. Restrictions were placed on the Company to supply all public lamps by meter—one meter to be fixed to every twelfth lamp, and every lamp to be supplied through a regulator, the cost of which was to be charged to the public authority. The registration of the meter was to be taken as representing the average consumption of the twelve lamps. The price charged for the gas consumed in the public lamps was to be at the same rate per 1000 cubic feet as the lowest price charged to any private consumer.

In 1873, the Company obtained power to double their capital; but in 1874 the undertaking was sold and transferred to the Corporation. The terms of purchase were that for every share of £50 the Corporation should pay an annuity amounting to £3 2s. 6d. during the first seven years from the date of transfer, and afterwards a perpetual annuity at the rate of £3 5s. for every share of £50 held by the proprietors. The annuities were to be secured on the revenue of the undertaking, and afterwards on the borough fund and rates leviable in the borough of Nottingham. The mortgage or bond debt of the Company was continued a first charge on the undertaking in the hands of the Corporation.

The district at the time of the transfer was a most extensive one. The Company had run their mains out in all directions, to supply the numerous and populous villages in the vicinity; and one of the conditions for the withdrawal of opposition by the outlying districts to the passing of the Bill, was that the Corporation should abolish the differential charges which had been hitherto made by the Company, and for the future should supply all the parishes then taking gas at the same price as that charged to the consumers in the borough. The area of the district of gas supply is, I believe, the largest throughout the country—extending over 133½ square miles; or, roughly, it is 12 miles long by 12 miles broad, and the consumer at the extremity obtains his gas at the same price as the one whose house immediately adjoins the gas-works.

Up to the time of the transfer, the consumption had been regularly doubling itself every ten years; and the necessity for a large extension of the works had become imminent. The Corporation rapidly acquired additional land, and proceeded with considerable extensions at Basford and Radford. The rate of increase continued at the same ratio during the next ten years; but it has considerably fallen off during the last decade. In 1854, the consumption was 118 millions; in 1864, it was 289 millions; in 1874, 572 millions; in 1884, 1162 millions; and in 1894, it is estimated it will be 1450 millions.

During the ten years which followed the transfer to the Corporation, the business was so successful that a reduction in price of 1s. per 1000 cubic feet had been made in six equal instalments—thus bringing the price of gas down to 2s. 2d., 2s. 3d., and 2s. 4d. per 1000 cubic feet according to consumption. Since then the increase in the cost of coal has necessitated a temporary rise of 2d. per 1000 feet in the price of gas, leaving the scale of charges to-day at 2s. 4d., 2s. 5d., and 2s. 6d.

In addition to the very considerable reductions which were made in the price charged to the consumers, the Corporation have been able to build up a reserve fund of £100,000, and hand over for the improvement of the town, during the last twenty years, over £250,000. The present capital stands at £914,419, or £6 7s. 7d. per ton of coal carbonized. The coal carbonized during the past year was 143,355 tons.

The gas is made at three works—Eastcroft, Radford, and Basford—all of which are in communication with each other by means of trunk mains. The maximum daily output of gas is about 8½ million cubic feet.

In addition to gas, the Corporation work up both products, tar and ammoniacal liquor, manufacture sulphuric acid, consume their own spent oxide of iron, and make all the new oxide for their requirements. The chemical works are situated about eight miles from the town; and the products are conveyed there by rail or canal. Recently, however, a sulphate plant has been erected at the Basford Gas-Works, to deal with the liquor produced at these and the Radford works. The result has been a saving of from £2000 to £3000 per year.

In addition to the gas and chemical works, the Corporation possess, in the heart of the town, a handsome block of buildings, consisting of a show-room for gas-stoves, and workshops in connection with the distribution department.

The public lighting of the borough is in the hands of a separate Lighting Committee, of which the Vice-Chairman of the Gas Committee is the Chairman. There are about 3500 lamps in the borough, of which a large number are of modern type and high candle power.

The main features of interest to be inspected at the Eastcroft works are the new block of buildings now in process of completion, constituting a purifier-house, tar and liquor storeage tanks, engines, meter and governor house, boiler-house, store room, and overhead tanks for water, tar, and ammoniacal liquor. The purifiers, a set of four, each 40 feet by 30 feet, are elevated about 10 feet above the floor, and rest on columns and girders. Beneath them is a floor for revivifying purposes, on which two lines of rails are laid, to enable the purifiers to be discharged direct into railway waggons when desired. The purifying material will be elevated by means of an endless chain and buckets. The purifier covers, which each weigh about 14 tons, will be raised and lowered by hydraulic "Goliaths."

Beneath the revivifying floor are the tar and liquor storeage tanks, about 15 feet deep, and extending over the whole area of the purifying house. These tanks are constructed of brickwork laid in cement, with a waterproof lining of a pitch preparation filled into a cavity left in the walls for the purpose. The capacity, when full, is equal to about 28 days' maximum make of tar and liquor. In the engine-house there are two station-meters of 100,000 cubic feet per hour capacity each; two exhausters and engines of similar power; and one of 60,000 cubic feet per hour capacity. There are four of William Cowan's patent governors—two 24-inch; one 18-inch; and one 14-inch. There is also a set of 6-inch water-pumps and an engine and dynamo for the supply of electricity to the whole block of buildings, which will be lighted by from sixty to seventy 16-candle power incandescent lamps. This system of lighting has been decided on, on account of the greater degree of safety which attaches to the incandescent lamp than is possible to attain with any system of open-flame lighting.

The various engines are to be supplied with steam from three Lancashire boilers, each 28 feet by 7 feet, fitted with a fan-blast and Perret's patent dust-fuel furnaces. A new chimney stack, 105 feet high, has been erected for these boilers. Above the boilers is a set of cast-iron tanks for water distribution over the works, and for the loading tar and liquor into boats or railway trucks. These extensions have been designed for a daily make of gas ranging from 3 to 3½ million cubic feet per day.

It will be noted that two of the gasholders are in process of being converted from two-lift holders into four-lift ones, thus increasing the capacity about 87 per cent. One holder has already been converted, and is at work; and a fourth is about to be commenced and treated in a similar manner. The upper lift of these holders goes right out beyond the framing, and is guided entirely by the Pease system of steel-wire ropes.

The whole of the above new work, which is in large part a renewal of plant worn out and out-grown by the productive capacity of the rest of the works, is being carried out at a cost of about £40,000; and, when completed, all the apparatus will be well up to its work, and in proportion to the maximum output of gas.

Another feature of interest at these works is the system of gaseous firing in the retort-houses. The retorts in each house have been converted to the regenerative system during the past three years. Great economy resulted in labour, fuel, and wear and tear—besides which the output of gas has been increased more than 50 per cent. on the same area of ground. These retorts are all fitted with the most modern appliances; the waste heat is utilized to the utmost in raising the temperature of the cold air on its way to the combustion chamber; and finally, before entering the chimney, it is made to do duty in raising steam for use in the furnaces below ground.

At the Basford works, the most interesting features are: The new sulphate of ammonia plant erected two years ago to deal with 90 tons of liquor per day, and the Claus sulphur-recovery plant in connection therewith. The cost of the plant, buildings, fittings, and all complete was about £6000, the whole of which will be recouped from diminished working expenses in rather less than three years.

In the large new retort-house, there are now ten beds of regenerator settings of retorts in process of erection; each bed containing eight 20-feet through retorts, to be fitted up with all the best modern appliances, including a water-tube steam-boiler for feeding the furnaces.

Adjoining this house is a newly-erected coke-breaker and washing machine, capable of dealing with 30 to 40 tons of coke per day. The coke is broken and sorted by means of a revolving screen into four sizes—three of which are washed and cleansed for smithy use. There is a good market for coke thus prepared, in which the demand is steady and fairly constant throughout the year. Two scrubbers are in process of being lengthened.

Another feature of interest at these works is the experimental plant for coal-testing, and the laboratory for testing the various other products.

These works stand on an area of about 22 acres, and have retort power for producing about 5 million feet of gas per day. The retort-house capacity is largely in excess of this figure.

At the Giltbrook Chemical Works, there are many features of novelty and interest to gas engineers. The sulphuric-acid plant is capable of producing 40 to 50 tons of vitriol per week; being provided with burners for coal pyrites, or spent oxide of iron. The acid is partly made from each of these materials; and it is turned out at a specific gravity of 120° Twaddell.

The sulphate of ammonia plant belongs to an old type, and is capable of producing 30 to 40 tons of sulphate per week. The greatest drawback in connection with this plant is the difficulty of disposing of the waste liquor, the whole of which has to be evaporated, and dissipated in the atmosphere in the form of steam. This, together with the cost of carriage of the crude liquor, raises the working expenses for sulphate manufacture here much beyond the figures attainable at Basford.

The tar-works are a source of interest in themselves. They are capable of dealing with 300 tons of tar per week. The tar is split up into crude products only, for all of which there is a separate and distinct market. At these works, new oxide of iron is made to meet the requirements of the various works; the production being equal to about 600 tons per annum.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

The Papers Presented at the Annual Congress.

In a previous issue of the JOURNAL, we published a general report, translated from the *Journal des Usines à Gaz*, of the proceedings at the recent congress of the above Society in Paris. We now give, from the same source, an epitome of the papers presented on the occasion.

The first matter to engage attention was the advantage of recuperative as compared with ordinary furnaces. This came up in a communication presented by M. Bouron, which, in the author's absence, was not discussed. The recuperative system specially dealt with was that of M. Magot; and, in order to demonstrate its value, M. Bouron took as a basis of comparison the furnaces erected at Lens. Having been in use for 22 months, the author was in a position to give the results of a fairly long spell of continuous work. The retorts are set in beds of six, and they are charged with 132 kilos. of coal, which remains in the retorts for 4h. 48m. The quantity of coal carbonized in 24 hours is 3760 kilos.; and the coke employed, 14·4 per cent. of the coal—being 208,137·6 kilos. per oven per annum. An ordinary furnace, consuming coke at the rate of 22 per cent. of the coal carbonized, would have taken 317,988 kilos.; showing a difference of 109,850·4 kilos. in favour of the Magot system. As the 109 tonnes are worth about 20 frs. per tonne, the saving amounts to 2180 frs. The retorts in the ordinary setting have to be renewed at the end of twelve months; whereas those in the Magot settings are said to run for some 30 months. The economy thus effected is put at 920 frs., which added to the 2180 frs. produces a total of 3100 frs. Deducting 6 per cent. for sinking fund, there is left a net profit of 2914 frs. M. Bouron gave the results of a trial of the Magot system applied to settings of nine retorts at the Fontainebleau Gas-Works in December last. From the 12th to the 21st of that month, 156,948 kilos. of Pas de Calais coal were carbonized; the actual weight of coke used being 22,172 kilos., or 14·1 per cent. Draught was maintained with a pressure of 2·5 mm. of water.

A short communication on a similar subject was presented by M. Mertens. It described a recuperative furnace for eleven retorts, devised by M. De Brouwer, Manager of the gas-works at Bruges, which has been in operation for nearly two years, at the Croix Gas-Works. The bench consists of two double ovens, set back to back; each setting containing eleven retorts, ranged in three rows—the two lower ones containing four, and the upper one three retorts. The two end retorts in the lower rows have only one ascension-pipe between them. The roof of the furnace is vaulted; and the interior measurement between the piers is 3·8 metres. The retorts are 3 metres long, 64 centimetres wide, and 34 centimetres high. The generator is of large dimensions. It is placed under the retorts, and does not project. The inlets for the primary and secondary air have sliding doors which permit of the quantity being perfectly regulated. The secondary air enters at the lower part of the excavation, and symmetrically on the two sides of the generator in three superposed retorts, of which the lower one is of cast iron and the other two of fire-clay. The burnt gases circulate round these retorts, and escape into the chimney; the draught being effected by two dampers placed on either side of the cast-iron retorts. Each of these settings produced easily 2500 cubic metres (88,250 cubic feet) of gas per day, or 227 cubic metres per retort, with four-hour charges. It was stated that much more could be made by increasing the temperature. The consumption of coke is from 12 to 13 per cent. of the weight of coal carbonized; and it is charged into the generator as it comes from the retorts. The vaults have not altered in shape, notwithstanding the width of the furnace; and no inconvenience has been experienced. The cost amounts to only 1000 frs. per retort, everything included.

The foregoing particulars with reference to the regenerative system were followed by others, communicated by M. Bachelay, in respect to the working of a furnace on M. De Lachomette's plan. This system was described by M. Moirand at the congress of the Society held at Lyons in 1890. A setting of eight retorts, to be heated by a generator, was erected last year at the Toulon Gas-Works, fired up on the 1st of December to dry the brickwork, and brought into use on the 6th of that month. In a period of five days, during which the setting was worked to its utmost capacity, in order to obtain from it rapidly the greatest possible quantity of gas, owing to the exigencies of the service, the following results were achieved: Coal carbonized, 35,500 kilos.; fuel used for heating the retorts, 10·23 per cent.; yield of gas, 28·50 per cent. As coke was readily saleable, in the month of January coal dust was mixed with it; and the following results were obtained with six days' work: Coal carbonized, 39,370 kilos.; fuel used for heating, 9·85 per cent.; yield of gas, 28·50 per cent. The proportions of coke and coal dust which were finally determined upon, and which ensured steady working, were about two-thirds of coke to one-third of dust (both by weight)—ranging from 486 and 245 kilos. to 457 and 229 kilos. In a run extending from the 12th to the 19th of April, 47,260 kilos. of coal were carbonized, and 4749 kilos. of fuel used; being at the average rate of about 10·05 per cent. The retorts are the Ω's of the Paris Gas Company, and are 2·9 metres long (outside measurement). The yield of gas is the general average of the works corresponding to the period of each of the trials. It is given with all reserve; ten furnaces constructed on various systems being at work at the same time. M. Bachelay estimates, however, that the yield should be higher with the Lachomette furnaces. To the foregoing figures may be added some obtained from Refines, where only the latter furnaces are in use, for the first quarter of the past year:—

	Production of Gas. Cubic Metres.	Cost of Coke Used (1 fr. per hectolitre).	Cost of Coke per 1000 Cubic Metres of Gas.
January . . .	327,800 ..	4475 frs. ..	13·70 frs.
February . . .	249,250 ..	3210 ,, ..	12·88 ,,
March . . .	221,650 ..	2990 ,, ..	13·49 ,,
Average			12·36 frs.

The subject of the production of steam by the waste heat from the furnaces in gas-works was introduced by M. Chevalet. It had previously occupied the attention of the Society on several occasions; and the author referred the members to M. De Lachomette's paper in 1878, that of M. Dauge in 1881, and M. Eichelbrenner's in 1886. From these communications, and the information he acquired by inspecting various installations, he came to the conclusion that, with the systems at present in use, from 10 to 12 kilos. of steam may be obtained per square metre of heating surface, and produce 1·66 to 2·11 kilos. of steam per kilogramme of coke consumed under the retorts. He expressed satisfaction with the production of steam in regard to the superficial area of heating surface, and thought it useless to attempt to exceed it. What was desirable was to improve the yield per kilogramme of coke burnt; and this he believed possible if certain precautions were taken in erecting the boilers. At the outset, M. Chevalet stated that he was not about to present anything very new or novel to the members. In proof of this, he reminded them that, as heat is soon lost along the sides or walls of the flues, it is essential that the boilers should be as near the furnaces as possible; and that, when there are several benches of retorts, it is better to place at the end of each a boiler having sufficient surface to recuperate the greatest possible quantity of heat, than to have a single boiler into which the whole of the smoke-gases from the various benches are conveyed. With regard to the kind of boiler to be employed, M. Chevalet said he was in favour of those having internal furnaces of the Galloway kind, as being the more practicable. He then proceeded to discuss the subjects of the useful effect of feed-water heaters, and the temperature of that water; and he concluded by saying he thought he had demonstrated the following points: (1) That it is to the interest of all gas-works, where there are engines and distilling apparatus, to produce steam by means of the waste heat from the furnaces, and that this may be easily done; (2) that the heating surface to be allowed should be 1 square metre per 10 kilos. of steam to be produced; (3) that the quantity of steam generated may reach 2 kilos. per kilogramme of coke burnt in the furnace, and may even exceed this quantity; (4) that, in order to obtain the same useful effects, the boilers and superheaters should always be supplied with boiling water as pure as possible; (5) that the boilers should be connected with the furnaces under fire, in order to produce the maximum amount of steam, and should contain a certain quantity of water to maintain regularity of pressure. In the course of the discussion on the paper, M. Desmazes expressed the opinion that the author's conclusions were too arbitrary; and that, generally speaking, no benefit was to be gained by utilizing the waste heat from the furnaces, when costly appliances had to be put up to allow of this being done. M. Mallet remarked that, with a setting of seven retorts, with a grate furnace, and a fuel consumption of 20 to 21 per cent., 4 kilos. of steam per kilogramme of coke used were obtainable. M. Lachomette agreed with M. Chevalet that boilers possessing facilities for being easily cleaned are preferable, because the presence of soot causes serious diminution of vaporization.

The next subject to occupy attention was the action of air and oxygen in the revivification of purifying material in close vessels, and in the purification of illuminating gas. It was introduced in a paper by M. Delahaye, who began by referring to what has been done the last few years in England, as recorded in the published Transactions of the various Associations of Gas Managers. The Committee of the Société Technique have deemed it advisable to direct the attention of their colleagues to the matter, and urge them to undertake personal investigations. Awaiting the result of this appeal, the author thought it might be useful to make known what is going on in this country; and the object of his paper was to indicate the applications of the system already carried out, and to summarize the results obtained—setting aside all theoretical considerations, in order to deal solely with the experimental part of the question. M. Delahaye then fully described the results obtained by Mr. W. A. Valon at Ramsgate and Westgate, and by Mr. W. Belton at Shrewsbury; and he expressed the opinion that the experiments conducted by these gentlemen seemed to be sufficiently conclusive to justify some trials of the system on a working scale in France.

A question of construction was next brought forward by M. Bouron, who gave a description of a gasholder tank made of iron framework and cement—possibly a modification of the Monier system of construction, described in the JOURNAL about two years ago. M. Bouron stated that the best combination of iron and cement is in the proportion of 1·60th of the former to 59·60ths of the latter material; and that this mixture will

resist a tensile strain of 5·35, as compared with 1 for cement alone. He cited, as an example of this kind of construction, the gasholder tank at Château-Thierry, in the building of which 6000 kilos. of iron and 70,000 kilos. of cement were used; making 550 cubic metres, or about 720 cubic yards of work. It cost 6200 frs. But if constructed of brick, it would have come to 7950 frs.; and if of quarry stone, to a little less—7136 frs. Beyond the economy, however, there has to be taken into consideration the fact that the system is not cumbrous, and is rapidly carried out; while in winter there is no rupture, or even crack, in the work. M. Bouron referred to the tanks constructed on this system at the gas-works at Ligny-en-Barrois, Dinard, Antibes, and Montreuil-sous-Bois. In the discussion on the paper, M. Leclerq said he had employed the cement-iron combination, and had found it recommendable for the repair of tank walls. M. Melon confirmed the opinion of M. Bouron as to the merits of the system. M. Jouanne cited the case of the tank at the Casino at La Bourboule, as an example of resistance to excessive temperatures.

The next two papers do not call for notice at any length. One contained a proposal by M. Garnier to establish a gas grill-room at the Lyons Exhibition in 1894. He suggested that it should be fitted up in the English style, and that all the culinary operations should be performed in view of the visitors; illustrated placards being placed upon the walls, to furnish information as to the consumption and cost of gas. He thought the project could be carried out for about 5000 frs. or 6000 frs. The other paper, which was by M. Giroud, furnished particulars as to the system of supplying hot water automatically from the fountains erected for the purpose in the public thoroughfares of Paris. Reference to these appliances has already been made in the JOURNAL. The fountain is composed of two parts—the water-heating apparatus, which is formed by seven concave and convex plates superposed, communicating with each other by means of tubes, and enclosed in a casing fitted with baffles to cause a circulation of the products of combustion between all the plates. The burner is composed of four concentric rings having 80 jets, and consuming altogether 135 litres (4·76 cubic feet) of gas at each operation. The working of the fountain is difficult to explain without the aid of drawings. Briefly, the insertion of the coin sets the mechanism in operation; the result being the heating of 1¾ gallons of water to 60° C., and its delivery, in 85 seconds, at a cost of 2c. for gas and a similar sum for water. The Company exploiting these fountains have put up twelve at Havre, at a cost of 1500 frs. to 1800 frs. each; and, at a given date, they will become the property of the town.

Following these papers came a description by M. Mahler of his now well-known calorimeter, for estimating the value of solid, liquid, and gaseous fuels; and then came a paper by M. Aguitton, dealing with the heat of combustion of coal gas, considered in relation to its illuminating power. On account of its scientific character, and of the interesting questions raised, the Committee of the Society reserved a detailed analysis of the communication until an opportunity had been afforded for carefully studying it. As, however, a copy of the paper has been courteously placed at our disposal by a correspondent, we were able to give the abstract translation of it which appeared in the JOURNAL last week.

It may be remembered that, in the course of his address on "Gas-Works as Central Stations for the Supply of Light, Heat, and Power,"* Herr von Oechelhäuser gave a pressure of 40 mm. as the one most suitable for Welsbach burners. According to a paper presented by M. Coindet, this gentleman systematically distributes his gas at Rouen so that it reaches the burners at a pressure of not more than 8 mm. to 12 mm. Being desirous of enabling the consumers to profit by the new light, he endeavoured to ascertain if it would not be possible to obtain with the lower pressure the same light as with the higher. In this he was successful; and the tables attached to his paper furnish some interesting and instructive results. They show that, by simply increasing the diameter of the gas passage from 0·476 mm. to 650 mm. in each of the five orifices in a burner passing 120 litres of gas per hour, by enlarging the four air-inlets from 6 mm. to 8·5 mm. each, and by augmenting the capacity of the air and gas mixing chamber by raising, to the extent of 25 mm., the gallery supporting the mantle, the maximum luminous intensity may be maintained with pressures as low as 7 mm. They likewise show that the pressure may vary from 7 mm. to 12 mm. without causing any large augmentation in the consumption of gas, yet with increased luminosity. It is found also that, by contracting the chimney at the height of the mantle, an increase of illuminating power to the extent of about 0·6 Carcel is effected. M. Coindet took the temperatures, and ascertained that the quantity of heat radiated from a naked Welsbach burner is not much more than that given off by an oil-lamp, although the light is five or six times greater. The mantles in these burners are very fragile; and in lighting, great care has to be taken not to damage them. In order to remedy this defect, M. Coindet arranged at the base of the burner, and outside the mantle, a small flash-light, which, when the tap is turned, ignites the gas through the meshes without causing any audible explosion. In the course of the discussion upon the paper, M. Lacaze referred to the necessity for employing rheometers to counteract the great variations of pressure which too often occur; and his remarks were strongly supported by M. Mallet. M. Coindet said he thought it would be difficult to find rheometers sensitive to 4 mm. or 5 mm. pressure. M. Giroud agreed that this would be so, if the instruments were small; but, if the size were increased, all desired sensitiveness could be obtained.

The remaining papers will be noticed in a subsequent issue.

* See JOURNAL, Vol. LXI., pp. 590, 635.

PACIFIC COAST GAS ASSOCIATION.

As already mentioned in the JOURNAL, an addition to the American Gas Managers' Association was made on the 11th of July, when a society bearing the above title was established, at a meeting comprising about fifty gas engineers, held at San Francisco. Mr. J. B. Crockett, President of the San Francisco Gaslight Company, was selected as the first President; Mr. Hallett, of Portland (Ore.), as Vice-President; and Mr. J. A. Britton, of Oakland, as Secretary. A Committee was also appointed, and a form of constitution and bye-laws adopted; and it was agreed that annual meetings should be held on the third Tuesday and Wednesday in July in each year.

The President proceeded to read a paper on "The Benefits to be Derived from the Formation of a Gas Association on the Pacific Coast." There were, he said, special circumstances, such as the distance from manufacturers of gas apparatus, and the numerous kinds of materials available for making gas, that tended to throw the gas manager more on his own resources than was the case in the Eastern States, and at the same time enhanced the difficulties of his position. These rendered an Association more desirable in their district than in places where a freer change of experiences was practicable. They had coals from Japan, from Australia, and from the northern coast; and it was desirable that their information as to the relative commercial value of these materials should be increased. The managers of small works could get valuable information from the large works; and, on the other hand, they had opportunities for watching matters and making experiments that could not be obtained in large towns. Some of the most valuable hints which he had received had emanated from the managers of small works. He therefore anticipated much benefit, not only from the reading of set papers, but from informal discussions. Besides the papers and discussions, the members would be brought into friendly contact one with another. A topic of special local interest at the present time was the electric light; for almost every small gas undertaking had found it necessary to be prepared to supply electricity. Then there was the question of water gas, and other processes. In concluding, he pointed out that Gas Associations had been formed in various parts of the world, and some were now of many years' standing. All were doing well; and thus showed that the District Association met a real want.

Mr. J. L. Hallett followed with a paper entitled, "Is the Electric Light Friend or Foe to the Interests of Gas Lighting?" He remarked that many of his neighbours had to recognize the competition of a first-class new electric outfit, coupled with bad demand owing to depression in business, or with such things as shale at £6 per ton and oil at 9d. per gallon. In towns that were really going back, every competitor was a detriment; but this was not necessarily so in growing localities. There the electric light would stimulate the gas people to greater exertions; and its brilliancy created a demand for more artificial light of all kinds. The competition of electric lighting had led gas companies to improve the quality of their gas, to increase some 30 per cent. the yield per pound of coal, to largely reduce the leakage, and to effect general improvements all round. The utility and reliability of gas constituted its stronghold; and they led to increased sales side by side with the adoption of the electric light. If any were losing ground, it was time to look round and see if they were thoroughly up to the times, and rendering the public as good service as their competitor. The answer to his question depended greatly on the quality and price of the gas, and the way that gas affairs were managed.

The President opened discussion by quoting figures to show that the introduction of electricity had not injured the sale of gas in San Francisco. Mr. Pearson, of Sacramento, said that electric light was more costly because it did not diffuse so well as gaslight. Mr. E. C. Jones quoted some figures showing that the consumption of artificial light of all kinds had, during the last thirty years, increased threefold per head of the population in Paris, as supporting the assertion that the demand for artificial light was extending. So long as this increase continued, there was nothing to fear from the electric light. Mr. Crockett directed attention to the fact that gas-engines were used, with success, for generating electricity. Mr. Parker said that an electric light undertaking was established in his district, and that he had not suffered by its competition. Mr. Britton remarked that he was supplying both gas and electricity, and fighting an opposition electric company. He pushed the use of gas in every possible way, had sold some 1500 stoves and 50 engines, and allowed a discount of 20 per cent. for gas used for other than lighting purposes. He had tried letting stoves on hire; but he found this was a losing game, and so he gave it up. He had largely increased his day output of gas, and at the same time was doing well with electricity, in his large and increasing district. Mr. Quilty said at San Jose his experience was very similar to that of the previous speaker. He

supplied both gas and electricity, and had an opposition electric company to contend with; but, in spite of all, his sales of gas were increasing. Other speakers also testified that they were doing well with gas and electricity when supplying both systems. Mr. Eichbaum referred at length to the large and continued increase in the consumption of gas in all parts of the world, and especially since the introduction of the electric light in 1877. Bearing this in mind, he could not regard the light as an enemy to gas. Mr. Phil. Meyer contended that it was better for gas companies to keep to gas, and do the most they could with it. By using the best burners, it was possible to compete successfully with electricity. Mr. Kemp agreed with Mr. Meyer.

The "question-box" being opened, attention was first directed to a new coal from Japan, Mr. Turner said that the Müke coal yielded 13,178 cubic feet of 15½-candle gas per ton, and 12 cwt. of coke. This was the result of a test of about 100 tons. Mr. Jones, who had assisted in the test, said the coal was liable to choke the pipes; and it contained a great deal of sulphur. They also tested some Yubarri coal, and found it yielded 12,700 cubic feet of 18-candle gas per ton, and 11½ cwt. of coke. He believed the Japan coal would do well to mix with other kinds. Mr. Hallett said he had tried the coal, and had obtained similar results; but, on account of the practical difficulties mentioned, he did not care to use it by itself. Another inquirer had requested information as to the use of tar in regenerative furnaces. Mr. Converse said that he had employed it satisfactorily—spraying it with a steam-jet, and keeping the fire-bars just covered with coke. Mr. Parker had also utilized tar with success. Several speakers gave detailed experiences in the use of tar; and Mr. Eichbaum contended that, if properly used, it did not shorten the life of the retort. The relative value of Australian and Kentucky shale was next discussed. It appeared that the former was richer as regards gas, but did not yield so much coke. In reply to the question, "Why should gas companies handle gas-stoves?" Mr. Crockett said they should do so because of the facilities thus afforded for increasing the use of gas. The gas company could not only sell at cost price, but take some interest in the stove after it was sold. Mr. Roper agreed that the gas company would push the stoves, but that the hardware man would not. Mr. Steinman had been very successful in selling stoves. In discussing the relative advantages and otherwise of steam-jet or mechanical gas-exhausters, Mr. Jones contended that the steam-jet might possibly increase the formation of naphthalene, but there were compensating advantages. Mr. Hallett said the steam-jet used more fuel than the other.

At the close of the business the members of the newly-formed Association were entertained at a banquet by the San Francisco Gaslight Company; and the following day was devoted to an excursion to the Union Iron-Works, the works of the Gas Company, and those of the Pacific Gas Improvement Company.

An Unusual Method of Water Purification.—A somewhat unusual system of water purification is just now being tried in the Croton watershed, whence the supply for New York City is obtained. It was reported that the water was being treated electrically. This is not so; but it receives a disinfecting liquid first prepared by passing an electric current through sea water. The salt in the water is said to be thus converted into hypochlorite of sodium, which, like chlorine, is an active disinfectant. Dr. Edson, the Health Commissioner of New York, has stated that the cost, independent of the fixed charges on the plant, is about 10c. per 1000 gallons.

Water Companies' Dividends on Old and New Shares.—A question of considerable interest to water companies who have not yet reached their maximum dividends has recently been raised in connection with two provincial companies. In one case—that of the South Hants Water Company—a dividend has been declared for the past half year at the rates of 5 per cent. per annum on the old ordinary shares and 3½ per cent. per annum on the new ordinary shares. Hitherto the Directors have been under the impression that the intention of their second Act was that the dividends should go on rising *pari passu* up to 7 per cent., and that, when they arrived at that point, the 10 per cent. shares should continue to increase (as the profits allowed) to 10 per cent. An interested shareholder questioned the accuracy of this; and the Directors obtained the opinion of Counsel on the matter. The result was that Counsel definitely stated that, according to their second Act of Parliament, the Company were bound to treat the two classes of shares *pro ratâ*—that was to say, the old 10 per cent. shareholders would go up at the rate of 10 per cent., and the new shares increase at the rate of 7 per cent. Otherwise, Counsel contended, they would not be treating the old shareholders in a proper way. The same question was lately brought to the notice of the Directors of the South Essex Water Company; and they caused a case to be laid before Mr. Buckley, Q.C., for his opinion. This concurred with that referred to above; and, in consequence, at the meeting of the shareholders last Wednesday, as reported in another column, the Directors recommended dividends at the rate of 4 per cent. per annum on the 1861 ordinary stock, at £2 16s. per cent. on the 1882 stock. Although the Directors have adopted the construction put by Mr. Buckley on the Company's Acts, the Chairman (Mr. W. Cracroft Fooks, Q.C.), still maintains that they could pay dividends at an equal rate up to 7 per cent. on the whole of the ordinary capital.

REGISTER OF PATENTS.

Purification of Coal Gas.—Hood, J. J., and Salamon, A. G., of Fenchurch Avenue, London. No. 15,925; Sept. 5, 1892.

In their specification (which is not illustrated), the patentees say: The gaseous impurities to which this invention relates existing in coal gas are three in number. First, carbonic acid; second, sulphuretted hydrogen; third, a class of bodies known as sulpho compounds, the chief of which is carbon bisulphide. Oxide of iron, or the manganiferous material known as "Weldon Mud," may be employed for the removal of the sulphuretted hydrogen; but hydrated lime is necessary for the removal of the carbonic acid, and sulphide of lime for the sulphur compounds, or hydrated lime may be used for the removal of all three impurities. The improvements here claimed relate to the employment of lime, in conjunction with Weldon Mud, in such manner as to render both these materials more effective in their several capacities—that is to say, the former material or hydrated lime more active for the abstraction of carbonic acid and sulphur compounds, and the Weldon Mud for sulphuretted hydrogen.*

In making their preliminary experiments, the inventors were guided by the following well-known facts: The material known as carbonate of lime—the ultimate product obtained by the gas maker, by the action of the carbonic acid in gas upon hydrated lime—exists in Nature in two different forms, exhibiting essentially different physical properties. These are known as calcite and arragonite. These two distinct forms of carbonate of lime may be prepared artificially; the former by precipitation from a cold, and the latter from a hot solution. Sulphide of lime likewise exhibits different physical properties, according to the temperature at which it is prepared. It has been long known that, if sulphide of lime be prepared with pure sulphuretted hydrogen, it is much more active in abstracting sulphur compounds and carbon bisulphide than if the sulphide of lime is prepared or fouled, as is usually done in gas-works, with the sulphuretted hydrogen contained in the coal gas. This fact, however, has nothing to do with the purity of the sulphuretted hydrogen employed.

The patentees claim to have found that, if freshly-slaked lime in a hot state, whether the heat be produced by chemical action of moisture or by other means, be employed for absorbing the carbonic acid in coal gas, this material will pass more than twice the volume of gas that cold slaked lime, as employed at the present time in gas-works, will do, before showing traces of carbonic acid passing—thus exhibiting a much greater activity of the hot lime over the cold lime for absorbing the carbonic acid; and the tendency is probably, under the hot conditions, to form arragonite instead of calcite, as above indicated. Their experiments have also shown that the sulphide of lime formed simultaneously with the carbonate, in the first stage of the purification, is of a less stable character, when the lime is employed hot, than when it is used cold. In other words, the sulphuretted hydrogen, like carbonic acid, is absorbed more readily by hot than by cold lime, but the carbonic acid displaces it from the sulphide of lime more readily in a hot state than in the cold. Thus the sulphuretted hydrogen is sent forward in a large burst by the carbonic acid, as the lime becomes fouled. Further, their experiments have shown that, if hot lime be employed for the preparation of sulphide of lime, the material thus formed is extremely active in absorbing sulphur compounds. If the active form of lime thus prepared is chilled or cooled, it loses much of its activity; but if it is again warmed, its absorbing power for the sulphur compounds returns to a greater or less degree. It is preferred, however, to maintain the temperature of the vessel warmed in the manner now to be indicated.

First, as regards carbonic acid. The patentees deposit the hydrated slaked lime hot into the purification vessels, or deposit the lime in such vessel unhydrated or partly hydrated, in lump, or in the form of ground lime; and they complete the hydration process by means of water or steam, or by both, and further maintain the heat by any suitable means—such as by the introduction of steam with the crude gas, or by warming a portion of the gas. By so doing, less of the carbonic acid is allowed to slip through the vessel than is usual in cold lime. There is also accumulated a longer continued stream of sulphuretted hydrogen, free from carbonic acid, which is sent forward either to form a hot sulphide of lime for absorbing the sulphur compounds or to be absorbed in Weldon Mud or oxide ofiron.

Secondly, it is proposed to introduce the slaked lime (intended for the formation of sulphide of lime) hot into the vessels, or prepared by the means previously described, at such a time as the former vessel—known as the carbonate vessel—is becoming foul; and thus the burst of sulphuretted hydrogen driven out by the carbonic acid from the first vessel is collected into the hot lime, so as to form a very active sulphide vessel. The temperature of this sulphide of lime vessel is maintained warm by the gas passing through the first vessel—known as the carbonate vessel—and which has been formed by the employment of hot lime, or by the introduction of steam with the gas at the inlet, or by warming a portion of the gas. If lime alone be not employed, Weldon Mud or oxide of iron is used for absorbing the sulphuretted hydrogen; and with the warm gas and the introduction of a small percentage of air, the activity of this material for absorbing sulphuretted hydrogen is very much increased over that when the material is employed cold.

The patentees further find that, when the lime is hot, the action as between ammonia which may be present in the gas in small quantities, carbon bisulphide, and lime, resulting in the formation of sulphocyanide of lime, is greatly accelerated; and in this way, the duty of the lime over carbon bisulphide is increased. In connection with the removal of the last traces of ammonia from coal gas by means of lime in the purifiers, they also find that it is greatly assisted by adding to the water employed to slake the lime a solution of calcium chloride The strength of this solution may vary, so as to meet the variation of the ammonia in the gas; but one-tenth part by weight of solid calcium chloride on the weight of water used in slaking is a convenient quantity. The employment of the calcium chloride in this manner

* In connection with this patent, see JOURNAL, Vol. LXI., pp. 924, 989.

also tends to retain moisture in the hot slaked lime when in the purifiers; and this assists in the complete retention of the carbonic acid gas by the lime.

Governing the Speed of Gas-Engines.—Andrew, H. H., and Bellamy, A. R., of Reddish, near Stockport. No. 17,277; Sept. 28, 1892.

The object of the first part of this invention is to simplify the governing mechanism of gas motor engines; and of the second, to cause the governor to throttle the supply of gas when the engine exceeds its normal speed, before the hit-and-miss movement which operates the gas-admission valve can come into play.

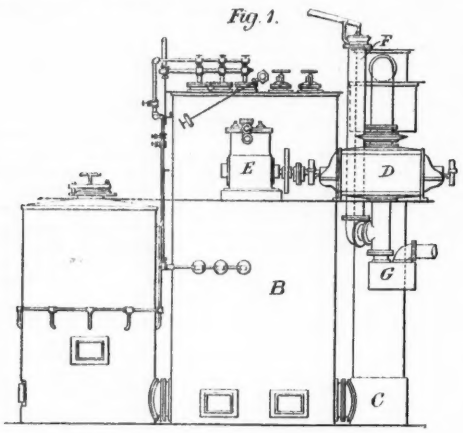
In carrying the first part of the invention into effect, a suitable centrifugal governor, the sleeve or other moving part of which is connected by rods to the end of a short lever, mounted on a short shaft or stud, is supported on the engine frame in such a manner that the movement of the governor produced by irregularities in the speed of the engine causes the lever to rock or oscillate on its stud. To the boss of this lever is also secured an arm, the end of which is shaped so as to keep the striking-finger out of contact with the hit-and-miss motion when the speed of the engine is too great; the hit-and-miss motion being actuated in any convenient manner.

According to the second part of the invention, the lever and arm are mounted on the spindle of a winged or other suitable throttle-valve; the spindle passes across the gas-inlet; and the wings are so arranged that the movements of the governor sleeve conveyed to the spindle cause the valve to partially close the gas-inlet, and throttle the supply, before the hit-and-miss motion which operates the gas-admission valve can be affected by the governor. The striker which actuates the gas-valve is held normally in contact with the admission-valve by a spring; and it is preferably mounted on a small elbow lever, the other end of which is acted upon by the shaped end of the arm mounted on the shaft or stud.

Manufacture of Illuminating Gas.—Newton, H. E.; communicated from R. N. Oakman, of Greenfield, Mass., U.S.A. No. 17,394; Sept. 29, 1892.

This invention relates to the production of illuminating gas, of any desired candle power, from water gas carburetted with oil or oil vapour; the apparatus employed being a gas-generator, a carburetter, and a gas cooler, in connection with which is an exhauster for drawing a constant stream of air or gas through the series.

Fig. 1.



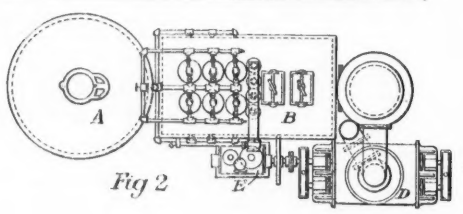


Fig 2

Fig. 3

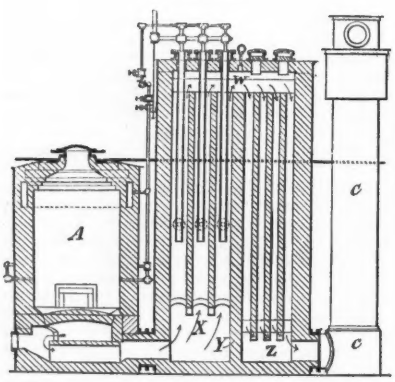


Fig. 4

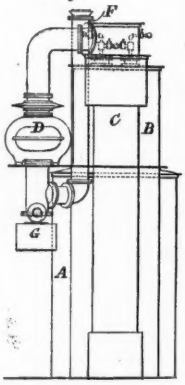


Fig. 1 is a side elevation of the plant; fig. 2, a plan; fig. 3, a sectional elevation of the generator and carburetter; and fig. 4, a rear-end elevation of the plant.

The generator A consists of a cylindrical metal shell, lined with fire-brick, and provided with a feeding or charging door at the top, a cleaning door on a level with the grate, an ash-pit door below an annular superheating chamber in the wall of the generator near the top, and a gas-exit opening from the ash-pit. Suitable pipes are provided for the admission of steam to the fuel bed, either through the superheating chamber or directly to the fire. The carburetter B consists of a rectangular or cylindrical metal shell, lined with fire-brick, and divided into two compartments X and Z by a fire-brick partition Y. These compartments are subdivided into a number of ascending and descending flues. The ascending flues are contained in the compartment X, and are connected with the generator at the bottom. At the top, these flues communicate by a channel W with a series of descending flues contained in the compartment Z; and these flues are in connection, at the bottom, by the gas-exit with the cooler C. Cleaning-doors are provided at the top and bottom. Iron pipes are provided in the carburetter B; and these are carried down through the roof, inside the ascending flues nearly to the bottom. The upper ends of these pipes receive steam-injectors, connected with the oil-tank and with the steam-generator, for the purpose of injecting the carburetting oil into the plant. Air-inlets are provided in the ascending flues, and also in the connecting channel W, as hereafter more particularly referred to. The cooler C (of any ordinary construction) is connected with the carburetter B at the lower end of the descending flues. It is also connected at its upper end with the induction side of an exhauster D, which is driven by a small engine E. The eduction side of the exhauster is connected, by an upcast pipe F, with the external atmosphere; and also, through a hydraulic seal-box G, to the scrubber or holder, as may be thought desirable.

The operation of the apparatus is as follows: The generator is charged at the top with fuel, which (the door being open) is ignited. When the fire is fairly alight, the exhauster D is started; and the fuel is brought to a state of incandescence, by drawing air in at the open top, and down through the fuel. As the fuel burns, the hot gases of combustion pass out to the bottom of the carburetter B, and up the ascending flues, heating the iron pipes contained therein, as well as the enclosing brickwork. Air is admitted at the top of the ascension-flues, to promote the combustion of the gases. The burning gases then pass down the descending flues; and the waste products escape at the bottom to the cooler C. In ascending through the cooler, the products give up more or less of their heat, which is utilized to generate steam. The gases then pass to the exhauster D, from which they are discharged, by the pipe F, to the atmosphere or to the stack. This operation is continued until all the fuel in the generator is thoroughly incandescent, and the carburetter B is brought to the proper temperature. Air may be admitted to burn a portion of the gases at this point, should a higher temperature be required in the flues than can be obtained by the sensible heat of the gases passing through. The proper condition of the fuel in the generator and the flues in the carburetter having been arrived at, the air-inlets, the door at the top of the generator, and the upcast pipe F are closed. Oil or oil vapour is injected down the iron pipes in the ascending flues of the carburetter; and steam is admitted into the superheater at the top of the generator, from whence it escapes into the generator. This steam is drawn down by the exhauster D through the incandescent fuel. It is thereby decomposed; and the resultant water gas then passes from the generator to the bottom of the ascension-flues of the carburetter, where it meets the heated oil vapour issuing from the iron pipes. The mingled oil vapour and water gas now ascends the heated flues, and passes out of the carburetter, as a "thoroughly fixed gas," to the cooler. Here it renders up some of its heat; and, being drawn by the exhauster D, it is forced through the hydraulic seal G, to either a scrubber or to the holder, as may be desired.

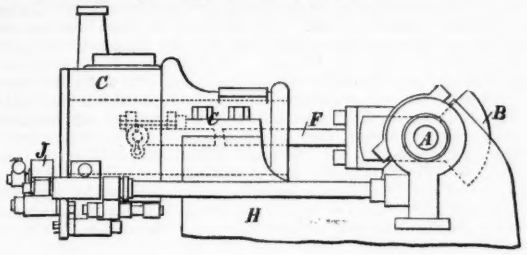
The exhauster is kept constantly in operation, whether when bringing the fuel to incandescence for making producer gas, or when introducing steam into the fuel to make water gas, or when introducing the oil to make carburetted water gas. In other words, not only the waste products, but the carburetted water gas, pass through the exhauster—the one going up the stack, and the other through the water seal to the holder, as before described.

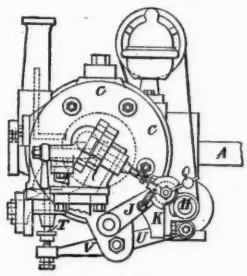
In explanation of his invention, the patentee says: According to the ordinary process of making water gas, sufficient pressure must be obtained by the steam in the generator to overcome the back-pressure of the gasholder on the water-gas seal, through which the water gas passes to the holder. In the case of this plant, however, pressure is not required, but the steam is exhausted down through the incandescent fuel—the resultant water gas being drawn into the carburetter. The quantity of water gas made per minute or hour can be governed by the admission of steam—that is to say, water gas can be made slowly, and with the admission of a small amount of steam into the generator, as it is not necessary to fill the generator full of steam in order to obtain the required pressure, and thereby cooling down the fuel bed too quickly. The fuel bed can, under the new conditions, be kept in a better condition for water-gas making; and a larger yield of gas per pound of fuel can thus be obtained. By means of the exhaust, in place of a blast, a more uniform temperature may be maintained in the carburetter; thus securing a more uniform quality of carburetted water gas. This is the most objectionable feature of the method of carburetting with a superheater, or fixing chamber, as it is sometimes called, and which this plant is designed to overcome. With the superheaters or fixing chambers heretofore constructed and operated for carburetting water gas, the want of uniformity of temperature in the superheater results in waste of oil, owing to its being converted into lampblack or tar, instead of being properly gasified or vaporized and fixed. The present "plant will, through its more uniform heating of the carburetter, not only make more gas of a given candle power from a given quantity of coal or coke and oil, but will make a carburetted gas of more uniform quality, and also will admit of the use of heavier oils than any other superheating system."

Gas Motors.—Dougill, J., of Manchester. No. 12,427; June 24, 1893.

This invention, relating to gas-engines, has for its principal object to obtain high speed combined with efficiency.

The engravings show an end and a side elevation of so much of the engine as is necessary to explain the object aimed at.





A is the crank-shaft; the crank being provided with balance-weights B, and with a suitable fly-wheel. The cylinder C, which is open at the end which is toward the crank-shaft, is provided with a trunk piston of ordinary form or construction. Applied to the cylinder end is a chamber containing the gas and air valves. The inner end of the rod F is connected to the piston by a special formation, designed to facilitate adjustment and to take up wear; and when the piston is at the end of its outward stroke, the screw head on it is conveniently accessible, so that the fit of the rod-eye upon the piston-pin can be regulated at any time, when the engine is at rest, without having to remove any part of the engine. The valve-chamber is formed so that there is a short, straight passage through which the mixed gas can flow into the cylinder. The chamber is also so fixed that the axial lines of the gas and air valves, when extended, meet the axial line of the side shaft H, or otherwise coincide with a radial from the axis of the shaft. The shaft is actuated by gearing in the ordinary manner, so as to make one revolution for two revolutions of the crank-shaft. Upon the side shaft H is a cam, which opens the gas and air valves at the required times. Interposed between the cam and the valve stems is a lever J, mounted upon a fulcrum stud, and provided with a bowl K, on which the cam acts. This lever is provided with an adjustable screw-stud, which acts as a pusher on the air-valve stem to open it.

The lever is so formed and fitted that a line drawn through the centre of the fulcrum and the line of contact of the pusher and the end of the valve-stem, makes a right angle with the axis of the valve-stem, or thereabouts. It will be seen that, when the cam acts upon the bowl K, the thrust of the cam is transmitted in a direct line to the valve. The gas-valve is opened by means of a governor-lever carried by the main lever J. This lever is provided with a pushing arm, kept in line with the end of the valve-stem by means of a spring.

A second arm of the lever carries a weight Q, which tends to act against this spring when the main lever is operated by the cam. The weight is so adjusted that, when the engine exceeds its normal speed, the end of the pushing arm is withdrawn, so that it does not strike the end of the valve-stem, and, as a consequence, the gas-valve is not opened. The exhaust-valve T (indicated by dotted lines) is operated by a cam on the side shaft; the cam acting through a lever V upon the stem of the valve at the required times.

When the engine is at work, the gas and air are admitted at every alternate stroke, as is usual in the "Otto" type of engine; the mixture of gas and air being compressed during the intermediate strokes, and fired by suitable means.

APPLICATIONS FOR LETTERS PATENT.

15,831.—KOCH, H., "Filters." Aug. 21.
15,846.—CURRY, A. W., "An improved valve." Aug. 21.
15,910.—HOLT, H. P., "Gas-generators." Aug. 23.
15,912.—VOISEY, C. B., and STEVENSON, W., "Improvements in, or connected with burners for burning gases or vapours." Aug. 23.
15,927.—A. and J. STEWART, and CLYDESDALE, LIMITED, and WOTHERSPOON, J., "Manufacture of ribbed tubes." Aug. 23.
15,950.—REYNOLDS, E., "Controlling the flow of fluid in pipes." Aug. 23.
15,986.—BAILEY, G., "Exhaust-silencer for gas and other engines." Aug. 24.
16,003.—DIX, H. A., "Measuring cocks or valves for liquids." Aug. 24.
16,010.—BROTHERS, W., "Manufacture of bicarbonate of ammonia." Aug. 24.
16,052.—RICHARDSON, W., "Pumps." Aug. 25.
16,074.—GEYER, A., and STEGMEIER, J., "Lighting gas by electricity." Aug. 25.
16,078.—SKENE, R., "Gas and oil vapour engines." Aug. 25.
16,079.—TIPPING, H., "Improvements in rotary pumps, blowers, and engines, also applicable for measuring fluids." Aug. 25.
16,087.—BEATTIE, W., "Pipe-joints." Aug. 25.
16,120.—OLDROYD, H., "Joints for pipes and tubes." Aug. 26.
16,134.—ISHERWOOD, T. E., RUTHERFORD, A., and HOLMES, D., trading as the Lancashire Gas-Engine and Engineering Company, "Governors for gas-engines." Aug. 26.
16,146.—GOZARD, L. F. X., "Sterilizing or destroying the micro-organisms in liquids by mechanical pressure." Aug. 26.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by our correspondents.*]

Licence for Stills in Sulphate of Ammonia Works.

SIR,—It may interest the directors and officials of gas companies to know that the Commissioners of Inland Revenue have, on application, returned to this Company the duty of 10s. paid for the year 1892-3 for a licence for a sulphate of ammonia still. They declined to return the duty paid for the previous year. Applications of a similar nature from other companies or manufacturers would no doubt be equally successful.

It appears that the decision in June last of the Court of Queen's Bench, in the case of *Sidgwick v. Sunderland Gas Company*, has convinced the Commissioners of the illegality of their attempt to apply the Act, 9 and 10 Vict., cap. 90, to sulphate-works.

C. CROWTHER-SMITH, Secretary,
Sept. 1, 1893. Southampton Gas Company.

MISCELLANEOUS NEWS.

PROVINCIAL GAS AND WATER COMPANIES.

In the paragraphs below, we give some particulars concerning the working of several additional gas and water companies carrying on their operations in the provinces.

Gas Companies.

In the course of his remarks at the meeting of the Derby Gas Company last Wednesday, the Chairman (Mr. H. Swingler, J.P.), referring in the first place to the coal strike, said he was pleased to be able to mention that it had not yet affected them. They had made such preparations that for the present they could continue working unaffected; and he was happy to announce that they were in a position to go on, on the present lines, for at least seven weeks with the stock of coal they had in hand. With regard to the accounts, they would be able to pay this half year, for the first time since he had occupied the chair, the full maximum dividends without encroaching upon the reserve fund. In addition to this, they should have a respectable sum to add to that fund. As to the revenue account, the expenditure for the first half of 1892 amounted to £24,597, and for the six months just ended, to £24,589. The revenue for the past half year totalled to £35,206, as compared with £32,728; being an increase of £1478. In coke they had lost ground, in consequence of the fall in prices; and the same remark applied to tar. But sulphate of ammonia had been better for them by £600—the prices having risen considerably. The report was adopted; and dividends of 10, 7, and 5 per cent. were declared on the various classes of stock.

The half-yearly meeting of the Douglas Gas Company was held yesterday week. The report which was presented showed that there was a net profit of £2622, which was an improvement as compared with the previous half year. The new contract for the supply of coals was favourable; but, owing to the miners' strike, difficulties had been experienced in obtaining deliveries. Including the balance brought forward from last year, there was an amount of £3522 available for distribution; and a dividend of 27s. 6d. was declared.

The annual report of the Directors of the Falmouth Gas Company states that the consumption of gas has been nearly half a million cubic feet in excess of that of the previous year; and that, the price of coal having fallen considerably, they are enabled to make a reduction in price of 3d. per 1000 feet. This will now be 3s. 6d., with a discount of 2½ per cent. for prompt payment, and a further discount of 10 per cent. on gas used for cooking, heating, and motive purposes, where a separate meter is fixed for registering the quantity consumed. From the net profits, an interim dividend at the rate of 10 per cent. per annum was paid in February last; and it is now proposed to pay a further dividend at the same rate, to transfer the sum of £168 15s. to the reserve fund, and to carry forward the balance of £54.

At the recent half-yearly meeting of the Normanton Gas Company, the Directors reported that there was an amount of £748 available for division among the shareholders; and they recommended a dividend at the rate of 8 per cent. per annum. In order to pay this, £52 will have to be taken from the reserve fund. The report was adopted.

The proprietors of the Sunderland Gas Company will meet to-morrow for the purpose of receiving the Directors' report and the accounts for the year ending June 30 last. The total revenue of that period has been £79,174; and the expenditure, £64,383—leaving a balance of profit of £14,791. An interim dividend was paid in March last; and a declaration of a like dividend of 5 per cent. on the original stock, and of 4½ per cent. on the additional stock is now recommended. The consumption of gas having greatly increased during the last few years, the necessity for providing for still further demands has been forced upon the Directors; and they are accordingly obtaining tenders and entering into contracts for an additional retort-house, gasholder, &c., at Hendon. To provide the requisite capital for these extensions, the proprietors are to be asked to create £40,000 of the additional capital authorized by the Company's Act. In view of the increased amount which will be required to pay dividends upon the capital, which for some time to come must be partially unproductive, the Directors are pleased to be able to state that, so far as the coming year is concerned, contracts for coals on much more favourable terms than have prevailed lately have just been entered into. In concluding their report, the Directors remark that they and the shareholders have alike to regret the great loss the Company have sustained by the death of their late lamented Chairman (Mr. E. C. Robson). He was elected a Director in 1849, and Chairman in 1854; and the sound judgment and discretion which he displayed in presiding over the affairs of the concern, contributed much to its past and present prosperity. For the purposes of comparison, the revenue account gives side by side with the figures for the past year those for 1891-2. In the year just ended, the receipts from gas and

meter-rental amounted to £58,101, as against £56,464 in the preceding twelve months. Residuals produced £20,706, as against £22,237; and sundries £367, as compared with £347. The expenditure was £64,383, or some £420 less than in 1892. Wages absorbed, £18,409, as against £17,740; coal, lime, &c., £27,947, against £31,832; rates and taxes, £2841, against £2636; and repair of works, mains, and meters, £10,773, as against £8471. The other items of expenditure exhibit very little variation.

The accounts of the West Kent Gas Company for the half year to June 30 last show that the total receipts were £6826, and the total expenditure £4474; so that the profits amount to £2352. This sum is not sufficient to pay the statutory dividends; but the disposable balance on the profit and loss account is £3575; and from this the payment of dividends at the rate of 8 per cent. per annum on the original shares and 7 per cent. on the new issue is recommended. The Directors, in their report, attribute the reduction in the profit to the slackness of trade and the unusually clear and hot weather.

In moving the adoption of the Directors' report at the meeting of the Wolverhampton Gas Company last Tuesday, the Chairman (Mr. H. W. Owen) remarked that the Directors considered it was, on the whole, a satisfactory statement. They did not expect to do so well in the summer half year, and had to draw upon the reserve fund; but in the winter half year they not only paid a dividend, but were able to carry a balance forward after paying back what had been drawn from the reserve. The present price of gas is 2s. 6d. per 1000 cubic feet; and the Directors hope there will not be occasion to advance the price. They had made the coal contracts on favourable terms; but if the strike in the coal trade continued, they might have to advance the charge for gas. They were going to raise £20,000, which was the first moiety of the authorized increased capital; and, with this addition, they would be able to carry on the concern for some time. They had power to raise £80,000; but the Directors would only call for such amounts from time to time as they found necessary for extensions. By adopting this course, they would always be able to pay the maximum dividends. The report was adopted; and the usual dividends at the rate of 10 per cent. on the ordinary stock and 6 per cent. on the preference stock were declared.

Water Companies.

The East Warwickshire Water-Works Company do not appear to be making such progress as the shareholders could wish to see. At the half-yearly meeting a few days ago, the Chairman (Captain Townshend) stated that the number of houses connected with the Company's system was 1580, against 1460 in the previous half year; while the amount of water-rates was £788, against £726 in the corresponding period of last year. An arrangement had been made with Sir Alfred Hickman for a further supply of water from the rock beds. The Chairman added that he had taken a large share in the Company with the idea that local assistance would be forthcoming; but this had not been the case to the extent necessary for the proper development of the concern.

At the ordinary meeting of the Leatherhead and District Water Company last Wednesday—Mr. H. Rokeby Price in the chair—it was reported by the Directors that the receipts for the past half year were £204 in excess of those of the corresponding period of 1892. The profit amounted to £415, to which had to be added £287 brought forward; making a sum of £702. Deducting the interest on the debenture stock, there remained £578 available for division among the shareholders; and a dividend of 2½ per cent. was declared. An extraordinary meeting was also held, at which a resolution sanctioning the raising of additional capital by the issue of £12,500 of ordinary stock and £3125 of debenture stock was adopted.

At the recent half-yearly meeting of the Sevenoaks Water Company, it was stated that the revenue for the past half year had increased, though only by the small sum of £45; and that the aggregate expenditure was £1247, in comparison with £1178. The balance at the credit of profit and loss account was £1158; and out of this sum a dividend was declared at the rate of 8 per cent. per annum on the consolidated stock, and £5 12s. per cent. per annum on the share capital.

The half-yearly meeting of the South Essex Water Company was held at the Guildhall Tavern, Gresham Street, E.C., last Wednesday. The Chairman (Mr. W. Cracroft Fooks, Q.C.) submitted the Directors' report, which showed that the result of the past six months' working was a net profit of £4254. After providing £180 for the half-year's interest on the debenture stock, there remained £4074; and this sum, added to previous balances, made £8731 to the credit of the profit and loss account. It was recommended that the 5 per cent. dividend on the preference stock (requiring £1752) should be paid. Since the last meeting, the Directors stated that they had caused a case to be laid before Mr. Buckley, Q.C., for his opinion as to the proper construction of the Company's Special Acts of 1861 and 1882 with reference to the rates at which dividends on the ordinary stocks had been and should be paid. In accordance with the construction he placed on those Acts and the Acts incorporated therewith, the Directors proposed that the profits available for distribution among the holders of the ordinary stocks should be divided at the rate of 4 per cent. per annum on the 1861 stock, and at the rate of £2 16s. per cent. per annum on the 1882 stock. The Directors further reported that the 4 per cent. debenture stock and 4 per cent. mortgage debentures, to the amount of £7250, had been raised during the half year for the purpose of extinguishing an equal amount of 4½ per cent. mortgage debentures. They also announced that £3100 of 4½ per cent. mortgage debentures had been paid off. The Chairman, in the course of his remarks, criticized the decision arrived at by Mr. Buckley in regard to the dividends. He said it was with very great regret that he felt it to be his duty, and that of his co-Directors, to put the passage referred to in the report. Speaking as a lawyer, it was his view that the Company could pay dividends at an equal rate up to 7 per cent. on both the 1861 and 1882 capitals. The persons who were mainly affected were those who possessed only the 1882 capital; the holders of 1861 shares receiving a larger amount of dividend. It had been his opinion that, so long as they only received a small amount of dividend, they could all share alike; and to his mind that was the only reasonable way of acting. The motion, which was carried, was seconded by Mr. J. C. Amos, who stated that a new reservoir which the Company are now constructing would have a capacity 50 per cent. greater than the old one.

The half-yearly meeting of the South Staffordshire Water Company was held last Thursday week. The adoption of the Directors' report—which was summarized in our issue for the 15th ult.—was moved by the Chairman (Mr. F. James). In the course of his remarks, he stated that the number of houses now supplied with water was increasing, and had now reached 80,000. He congratulated the shareholders on the fact that they had been able to amply supply the inhabitants in their district during the recent drought; while such places as Liverpool, Manchester, and Birmingham had been holding out the flag of distress. Their district, too, measuring 40 miles in length and nearly 40 miles in width, was probably more difficult to supply than any one of those. With regard to the accounts, there was an increase of £1160 in the half-year's water-rates, as compared with the corresponding period of last year; and the result of the working was a balance of £18,385, as against £18,960 in the first half of 1892. This enabled the Directors to recommend the declaration of a dividend of 5½ per cent. per annum, which would absorb £15,384, and leave £3001 to carry forward. Since the last meeting, they had run the gauntlet of parliamentary opposition, and had obtained the Bill for which they were authorized to apply. The Bill was passed with certain conditions; and he thought he was justified in saying that the local authorities who opposed them obtained nothing in the House of Commons that they cared for, and that they did not get that one thing which they went for. They came to an understanding which obviated a fight in the Committee of the House of Lords; and he believed the arrangements made as to the minor points in dispute were satisfactory alike to the local authorities and to the Company. He thought, however, that the Company had shown that no one single local authority could ever go to Parliament with success for the purpose of manipulating and lopping off a part of their great concern. Under the Bill they had got rid of any possible difficulty in their relations with the town of Dudley—a definite time having been fixed at which the scheme should come into operation; and they had agreed to supply local authorities in their area with water for public purposes at 7½d. per 1000 gallons. The report was adopted. Subsequently an extraordinary meeting was held for the purpose of creating and authorizing the issue of new ordinary and debenture stock under the powers conferred by the recent Act. The Chairman having stated that Parliament had empowered them to raise £150,000 in ordinary stock, with a corresponding amount of debenture capital, resolutions were passed rendering the parliamentary powers effective.

The half-yearly report of the Woking Water Company, of which we gave a brief notice on the 22nd ult., was submitted at the meeting of the shareholders last Tuesday. The Chairman (Mr. C. Horsley, J.P.) moved its adoption; and, in doing so, referred to the great strain which had been put upon water companies during the recent drought, in order to supply their customers. In their own case, they had not suffered so much as many other undertakings, and had been able to keep their districts satisfactorily supplied. There had been a few complaints; but the consumption had been more than 50 per cent. above the average. When the engines were added to the new well, the Company would have power sufficient to supply a district five or six times as large as their present one. During the half year the capital had increased to a small extent; and this would result in additional revenue. The receipts in the six months had advanced by £401; and the working expenses had been comparatively small, because the existing plant would double and treble the revenue with only a nominal increase in expenses. The balance of profit and loss account was more on this occasion by £379; and, after paying the interim dividend at the rate of 4 per cent., they would have £293 to carry forward. Considering they had to pay interest on extra capital, this was a good result—the balance being the best one they had carried forward for a long time. Speaking of the future, he said that they might have to pay a little more for coal; but they had just laid on 93 new services (which would bring in £220 a year) and 33 building supplies, the revenue from which would come in the current half year. Taking all things into consideration, he thought they were on a fair way to earn a further ½ per cent. dividend. The motion having been seconded by Mr. R. Hesketh Jones, the Engineer (Mr. J. Quick), referring to the satisfactory position of the Company's supply, mentioned that the consumption during the recent hot weather was 100 per cent. above the average, instead of 50 per cent., as stated by the Chairman. The report was adopted; and the dividend recommended declared—Mr. Jones remarking, in connection with the latter, that he hoped the shareholders would not run away with the idea that there was a possibility of them soon receiving an extra ½ per cent., as they had some suspense accounts to be settled yet.

In the report which was submitted by the Directors of the Wrexham Water Company at the recent annual meeting of shareholders, they stated that the expenditure on capital account during the past year amounted to £2226; and this was chiefly incurred in laying additional 9-inch and 7-inch mains, in order to meet the increased demand for water in the suburban portions of the town. The debit balance on the capital account (£4200) had been met by a *pro ratâ* allotment of 400 4 per cent. preference shares, for which applications were received many times in excess of the number required. The receipts upon water and fittings accounts showed an increase of about £300, as compared with the preceding year. After payment of the usual charges, the full dividends upon the preference shares and stock, the interim dividend of 5½ per cent. upon the consolidated stock, and interest upon mortgages for the year, a balance remained on net revenue account of £3704. The Directors accordingly recommended the payment for the past half year, of the full preference dividends, and a dividend at the rate of 5½ per cent. per annum upon the consolidated stock, all free of income-tax. During the year, water has been laid on to 202 houses; making a total of 4326 houses now supplied. In moving the adoption of the report, the Chairman (Mr. W. Overton) commented on the various statements it contained; and he concluded his remarks by saying that, taken as a whole, the working expenses compared favourably with previous years—the proportion being 27·3 per cent., as compared with 27·6 per cent. in the preceding year. The report was adopted.

CRYSTAL PALACE DISTRICT GAS COMPANY.

Half-Yearly Report and Accounts.

The report which the Directors of this Company will submit at the meeting of the proprietors on the 8th inst. is an interesting one. It states that the accounts show that the result of the half-year's working gives a balance to the credit of revenue account of £15,521, reduced, as shown in the profit and loss account, to £14,977, which is sufficient to pay dividends of £14,875, and carry forward £102. As compared with the corresponding period of 1892, there has been a reduction on coke, tar, &c., of £2484, but sulphate of ammonia has improved to the extent of £1061; and, as a result of the extraordinarily fine and hot weather, which has tended to check the use of gas, there has been a decrease of 4·47 per cent. in the quantity sold. It is mentioned that there has been an appreciable reduction in the cost of coals, compared with the first half of last year; but the benefit of the reduced prices under the present year's contract has scarcely been felt, because the new contract dates from the end of April, and there was at that time a considerable stock in hand. Referring to the Company's new Act (which received the Royal Assent on July 27 last), the Directors report that the capital powers are increased to the extent of about £100,000 of ordinary 5 per cent. stock, and about £250,000 of 5 per cent. debenture stock, including expected premium. The sliding scale will henceforth be applied, whereby, when the price of gas falls below 2s. 10d. per 1000 cubic feet, the stockholders will be entitled to an increase of dividend; but should the price rise above 3s. 2d., the dividend will be reduced. A considerable relief has been obtained in relaxation of the useless provisions relating to legal proceedings for excess of sulphur compounds in the gas. All the various stocks —10 per cent. and 7 per cent. ordinary, and 6 per cent. preference—have been converted by the Act into equivalent amounts of 5 per cent. stock—that is, the £75,000 of 10 per cent. becomes £150,000 of 5 per cent.; the £275,000 of 7 per cent. becomes £385,000 of 5 per cent.; and the £50,000 of 6 per cent. preference becomes £60,000 of 5 per cent. preference. It is also announced that a call on the debenture stock issued last year will be made, and is to be paid up before Oct. 1 next. When the remaining 5s. is paid up, this stock will also be converted into an equivalent amount of 5 per cent. debenture stock. The Directors recommend that a dividend be declared for the past half year at the following rates per annum: 6 per cent. on the preference stock; 7 per cent. on the ordinary 7 per cent. stock; and 10 per cent. on the ordinary 10 per cent. stock—amounting to £14,875, less the income-tax of £403. The revenue account shows that the total income for the six months was £72,840, which was divided as follows: Gas, £56,217; meter-rental, £1269; residual products, £15,322; and rents, £31. The total expenditure was £57,318, of which the manufacturing charges absorbed £47,009; distribution, £3897; public lamps, £1091; rents, rates, and taxes, £1651; management, £3105; and the balance was made up of minor items. From the manufacturing statements, we learn that 44,025 tons of coal and 136 tons of cannel were carbonized in the half year, and 23,818 gallons of carburine were used for enrichment. The amount of gas made was 442,247,000 cubic feet; and the estimated quantities of residuals produced were as follows: Coke, 529,932 cwt.; breeze, 5350 yards; tar, 441,420 gallons; ammoniacal liquor, 883,220 gallons; and sulphate of ammonia, 390½ tons.

TOTTENHAM AND EDMONTON GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Saturday week, at the Offices, Willoughby Lane, Tottenham—Mr. GEORGE GRIPPER, J.P., in the chair.

The SECRETARY (Mr. J. Randall) read the notice convening the meeting; and the report and accounts (an epitome of which appeared in our issue for the 22nd ult.) were then submitted.

The CHAIRMAN said the increase in the consumption of gas during the past six months had been very small; and there was no doubt that the reason for this was that through March, April, May, and June, we had exceedingly hot weather, and people burnt less gas week by week. The increase was only 1·92 per cent., but in the preceding half year, it was 10·70 per cent.; so that over the twelve months they had made very satisfactory progress. With regard to cooking-stoves, they had a large increase—viz., 19 per cent.—on the number let out at this time last year; showing that the weather had helped them in this respect. Residuals were still one of their great troubles; they would not rise. Coke was very low in value; and as to tar, the price was not one-third what it was three years ago. Sulphate of ammonia had improved; and they hoped to make still better prices. Concerning coals, they had been able to contract for their supply for nearly two years forward at a considerable reduction on the present price, and more considerable still on the prices paid two years ago. The contract was now under 13s. per ton, instead of 15s. 2d. Another thing the Directors felt satisfied upon was the fact that they had about 6000 tons of coal on the works; so that they would be perfectly free from any pressure during the strike. In the contract was a strike clause, under which, should they have to buy any extra coal, they would have to pay strike prices; but he was glad to say, the amount in stock would carry them on for several weeks. Respecting the extension of the works, the new gas-holder tank was completed; and the holder itself was in an advanced position. Owing to the magnificent weather, the contractors were able to finish the tank well within the specified time. The Company had also taken possession of the additional land adjoining the works, which was referred to in the previous report. During the half year the Directors' had issued £15,000 of new "C" capital; and the price averaged just under £160 per cent. This was a lower price than was obtained for the first portion of it; but all classes of shares stood rather low at the present time, so that the Directors considered £160 was a very fair figure indeed. On this account, they had a premium of about £8950. The result of the working was that, taking the whole twelvemonth, they had earned their dividend within a few pounds. This they had not done since 1889, but had had to fall back upon the undistributed profits in order to pay the dividend. He did not think there were many other gas companies so near town who could say they had realized sufficient to pay their dividend during the past twelve months. The penny-in-the-slot system of purchasing gas had now been adopted by the Company. By this means, they did not trouble people for a deposit; and the Directors were determined to give the working class all possible facilities for obtaining gas. They laid the gas into the cottages without any expense to the consumer; and they only charged a minimum price for the gas—a penny per 25 cubic feet, which came to much the same price that the ordinary consumers were paying. He hoped this would lead to a considerable increase in consumption. The only obstacle they had was the fittings, as poor people did not like to lay out 14s. or 15s. on them. He concluded by moving the adoption of the report and accounts.

Mr. J. WARREN seconded the motion.

Mr. W. HALL inquired if it would not be possible to issue to the proprietors (say) a 4½ or 5 per cent. preference stock equal in amount to the value of their present holdings. He was afraid that, calling their dividends 11½ and 8½ per cent., led many people to think they were getting a larger return for their money than they ought to do.

The CHAIRMAN replied that they had not the power to convert their stock in the manner suggested. It was quite true, however, that to some people the dividend declared appeared quite preposterous; but taking the last issue of stock, at the price paid, it would only work out to about 5·3 per cent. In answer to a question by Mr. Bailey, he added that there was an increase in the item of rates and taxes. Two of the parishes—Tottenham and Edmonton—had raised their rates; but the increase was really due to the additional assessment of the works.

The motion was unanimously carried.

Mr. CORBET WOODALL moved the declaration of dividends at the rate of 11½ per cent. per annum on the "A" stock and 8½ per cent. on the "B" and "C" stocks, less income-tax. In doing so, he said he would have proposed the resolution with very little remark, had it not been for the fact that, as the shareholders would have seen from the accounts, they were declaring a dividend once again very considerably in advance of the amount of profit that had been earned in the half year. As the Chairman had mentioned, taking the whole year, they had, within a trifling amount, earned the dividend; but in the half year they were some £1700 short. There were several reasons for this. In the first place, the receipts for residuals, small as they were last year, had still further fallen. For coke they had received £250 less, and for tar £600, against which they had an advantage of £290 on ammonia; so that the net loss was £560. Then (he jocularly remarked) their Engineer had chosen a bad time to increase his repairs of works and mains, and had managed to spend about £500 more than he was in the habit of doing. These two items together accounted for the fact that the Directors had a comparatively unsatisfactory statement to put before the proprietors. He had no hesitation in saying there was nothing whatever to be concerned about in the fact that they had again to draw upon their undivided balance. This balance was a most unsatisfactory item. It dropped to about £200 this time last year; and now they wanted from it £1700 to make up the dividend, which was about the amount they were able to add to it last half year. The reserve fund, which was expressly provided to meet bad times, had never been touched for ten years past; and the sums they had used to meet these occasional seasons of stress were simply undistributed profits from previous half years. It must be gratifying to the shareholders to learn that the coal supply had been obtained at a further reduction in cost. At present the state of things in the coal market was very uncertain and anxious. Their stock of coal was sufficient to carry them over the present strike at any rate; but as to what the effect of the strike would be on the permanent price of coal was a matter on which it was not possible to say anything. The workmen, it seemed, had put themselves in the wrong by not accepting arbitration; but it was to be hoped they would soon come to a better state of mind. So far as the general position of the business was concerned, the electric light continued to be "the light of the future;" but it was not an embarrassing light to the Company. The shareholders would have probably noticed that they had not divided in the accounts the amount spent in coal and oil; but they had expended a large sum in oil in the half year for the purpose of enrichment, and in one form or another they would still use that enricher, and so prevent any further increase in the high price they had to pay for cannel coal.

The proposition was agreed to.

On the motion of Sir H. CARTWRIGHT, seconded by Mr. BAILEY, Mr. Gripper was re-elected a Director; and on the proposition of the CHAIRMAN, seconded by Mr. W. S. WRIGLEY, Mr. Woodall was also re-elected. Afterwards, on the motion of Mr. S. CUTLER, Mr. Baynes was re-appointed an Auditor.

A vote of thanks having been passed to the Chairman and Directors, a similar compliment was paid to the Secretary (Mr. Randall), the Engineer (Mr. W. H. H. Broadberry), and the respective staffs.

Mr. BROADBERRY, in acknowledging the vote, remarked that, as regarded the financial position of the Company, they were really £250 better off than they were this time last year; and, taking all things into consideration, they might congratulate themselves upon getting successfully through a very trying year. Respecting the new holder, during the construction of the tank, they only had about two days' rain, and the contractor finished it quite ten days under the specified time; and he had no doubt that Messrs. Cutler and Sons, who had the holder in hand, would do as well. With reference to the prepayment meters, they were going out almost as fast as they could be obtained. Besides the penny-in-the-slot meters, they also had those in which a shilling could be inserted, as some people appeared to think it was *infra dig.* to put only a penny in the slot. On the question of coal, he said they had not paid so much for it as in the corresponding half year. According to the balance-sheet, it looked like 1½d. per ton less, but really the saving was more than that, because it had to be divided over the stock they had in hand. They had sufficient coal for ten weeks in store; so that they were perfectly safe.

This concluded the proceedings.

MANCHESTER CORPORATION GAS, ELECTRIC LIGHTING, AND WATER ACCOUNTS.

The annual abstract of the accounts of the several departments of the Manchester Corporation for the year ending March 31 last was issued last week. Though the figures are voluminous, the accounts are stated with admirable clearness, and in fulness of detail leave nothing to be desired.

With regard to the finances of the Gas Department, however, the present accounts add little or nothing to the very full statement which accompanied the annual report, and which was reproduced in the JOURNAL on July 11 last. The Auditors (Messrs. Ashworth, Mosley, and Co.), in their report, point out that the net revenue of the department for the year ending March 31, 1892, was £74,278; while that for the past year was £64,793—a decrease of £9485. The amount of gas profits handed over to the city fund in the past year was £46,046, as compared with £55,596 in the preceding year. The increased amount received for gas from consumers in 1893 was £32,431, which is equivalent to 8·14 per cent.; but the residual products realized £14,692 less. There is a net profit of £64,792, they also observe, after having set aside £13,954 for sinking funds; while the amount charged against revenue in the past year for renewals was £18,845. The loan debt to the extent of £13,330 has been extinguished during the year.

What is practically a new account appears this year in connection with the establishment of the electric light in the city. Under the Order which the Corporation obtained in 1890, they were authorized to borrow £80,000 for electric lighting. Up to March 31, they had raised £50,200 of this sum—£10,000 being at 3 per cent.; and the balance of £40,200 at 3½ per cent. The total amount expended to March 31 was £41,720; the items, omitting shillings and pence, being: Land, £2161; buildings, £9337; machinery, £13,196; mains, £14,077; expenses prior to generating electricity, £2906.

In regard to the Water Department, the result of the year's working is a deficiency of £8711. The total receipts for water supplied amounted to £236,511; and there were other items—such as meter-rents, farm rents, bankers' interest, &c.,—amounting to £8687, and making the total to the credit of profit and loss account, £245,199. The payments included £5262 for rents; £22,648, for materials, contracts, wages, and expenses connected with the maintenance of the works; £7095, for wages in connection with the general business of the department; £4690, for salaries; £3211, for collection; £1127, for law charges and other expenses in connection with the borrowing of money; £2257, for rent of offices; £906, miscellaneous expenses; and £777, for bankers' interest and commission. A balance of £181,912 is carried down, against which there is charged £143,441 for dividends, interest, and annuities, and £47,182 for sinking fund—leaving the deficiency, as stated, £8711. It may be interesting to notice that, of the total revenue of £236,511 from water supply, £145,066 is derived from within the city, and £91,444 from beyond. The extra-municipal revenue includes £49,123 for domestic water supply; and £25,143 for water supplied to the Salford Corporation and various local authorities and companies. The net expenditure during the year on capital account has been £238,222, of which £4205 was on account of the Longdendale works, £227,741 on account of the Thirlmere works, and £6275 for the works for supplying hydraulic power. The capital account now stands at a total of £5,742,384. The liabilities are for loans, annuities, &c., £4,780,725; and for sinking fund, £961,658. The assets are represented by the cost of the old Company's works, £533,561; cost of the Longdendale works, £2,614,332; cost of Thirlmere works, £2,368,111; cost of works and land for hydraulic power, £22,384; cash in bank on construction account, £200,835; and cash in bank on sinking fund account, £3159.

THE CRISIS IN THE COAL TRADE.

The story of the events of the past week in connection with the great struggle in the coal trade is an interesting one. In the opening there were signs that the strike in South Wales was not likely to be very prolonged; and as early as Tuesday morning, it was reported that collieries employing 35,000 to 40,000 men had resumed work.

But to continue our record from the point we left it last week, on Monday a meeting, composed, it was estimated, of from 25,000 to 40,000 men, was held at the famous Rocking-Stone, near Pontypridd; and it was addressed by Mr. Ben Tillett, on behalf of the Miners' Federation. Briefly summarized, his speech amounted to this—that the men had been fooled by the sliding-scale; that without organization they were a mere rabble; and that they should join the Federation. He also told them that he would like to see them manage their mines themselves, and form co-operative societies. A resolution reaffirming the demand for 20 per cent. advance in wages was carried; and a vote of censure on those who had gone to work was passed. In accordance with a resolution agreed to on the previous Thursday at a mass meeting at Trebanog Mountain, the house-coal workmen of Tonyrefail, Penrhiwfer, Cicely, and other places bordering on the Rhondda Valley resumed work on Monday at Penygraig; and on the same day all the pits in the Aberdare Valley were working, with five exceptions. From the Black Country district of South Staffordshire came the statement that, where the men worked under a sliding scale, the pits had been exceedingly busy since the South Wales strike began, and the men had been earning good wages. In connection with this day's doings, there has to be chronicled an outbreak of violence of a very serious character at the Holbrook Colliery, Killamarsh, Derbyshire, belonging to Messrs. J. and G. Wells, Limited, of the Eckington Collieries. The Company had stocked at Holbrook about 12,000 tons of gas and household coal; and up to the end of last week, it had not been drawn upon. On Monday morning a body of men were sent to load this coal into waggons. Their movements were observed by the men on strike; and a large number of them immediately began to assemble. Gradually they invaded the fields surrounding the colliery, and eventually broke through the fences, and drove the men from their work. A portion of them escaped by the fields, but were followed by a crowd, and most of them were very brutally beaten and kicked—some being seriously injured. The crowd, growing in dimensions and increasing in anger, stoned the police, who had been summoned, and drove them into the buildings for shelter, all the windows of which were smashed. Several men were badly injured with stones and sticks; and the strikers prevented any work being done.

On Tuesday, the Executive of the Coalowners' Federation met at the Westminster Palace Hotel, to consider the resolutions passed by the Miners' Federation on the 23rd ult., as noticed in the JOURNAL last week. The proceedings were strictly private; but it was agreed that the following statement should be communicated to the Press: "At the meeting of the Federated Coalowners held at Westminster Palace Hotel, the following letter from Mr. Thomas Ashton, General Secretary of the Miners' Federation of Great Britain, was received: 'I am instructed to send on to you a copy of a resolution passed at a conference of the above Federation, held at St. Martin's Town Hall, London, on Wednesday last, Aug. 23—' That this conference hereby agrees, that, subject to the coalowners withdrawing the notice for 25 per cent. reduction in wages, we pledge ourselves to resume work at once, and not ask for an advance of wages until prices reach the 1890 level, and that this resolution be forwarded to the coalowners' Secretaries (Mr. T. R. Ellis and Mr. Parker Rhodes.)' It was unanimously resolved as follows: (1) That the federated coalowners asked for a reduction in wages on the ground that the selling price of coal had very largely decreased; the rates of wages having been formerly advanced because the selling price had increased. That, notwithstanding that the output in the Midlands had been almost entirely stopped for a month, the comparatively small demand for coal still further emphasizes the very great depression in trade. (2) That the facts that the selling price has largely decreased and that trade generally is depressed are admitted. The proposal now made on behalf of the Miners' Federation is in effect that the advances in wages conceded in the years 1880 to 1890, at a time when the selling prices of coal were higher than they have been at any period in recent years, should be continued, notwithstanding such admitted heavy fall in selling prices. (3) From a resolution passed at the miners' conference on Aug. 23, and published in the Press, it appears to be contemplated, in order to raise selling prices to a point which would justify the payment of the rate of wages prevailing before the stoppage, that a combination between employers and workmen be established for the purpose of placing an artificial value on coal. The coalowners cannot accept such a combination as being to the advantage of the trade, the miners, or the public, and believe it would result in disaster to both employers and employed. (4) The coalowners regret that this proposal for wages to remain as they were when the notices were given cannot be entertained. (5) The coalowners regret that their original offer to submit the whole dispute to arbitration, which is still open, has not been accepted, and that the attitude taken up by the Miners' Federation affords no basis for a settlement. (6) That a copy of this resolution be forwarded to Mr. Thomas Ashton, the General Secretary of the Miners' Federation of Great Britain, and to the Press." An important and gratifying statement was also issued by the Emergency Committee of the Monmouthshire and South Wales Coalowners' Association, giving a list of the associated collieries which were then at work. These represented an output of coal at the rate of 9 million tons per annum, and afforded employment, as previously stated, to from 35,000 to 40,000 men. It was also reported that, at the Llwyny pit, colliers as well as hauliers had indicated their desire to resume work; and everything would be arranged to admit of this being done. The output of these pits is about 750,000 tons per annum. The colliers of South Wales and Monmouthshire held a mass meeting at Blaenavon on the same day. A resolution was carried, with only about 20 dissentients, denouncing the "demoralizing effect" of the sliding-scale upon the miners; declaring that those present felt justified in demanding the advance of 20 per cent. forthwith; supporting the action of the hauliers; and calling upon those men who had returned to work to leave it. Much indignation, however, was caused by a proposal that the Blaenavon men should retire from the general meeting, and take a vote on their own account. This they did; and their decision was soon after reported as being in favour of resuming work, although the voting was very even. Another great meeting was held at Pentre, in the Rhondda Valley, at which the resolutions passed at Monday's gathering were emphasized. A few smaller meetings were held; but nothing of any importance transpired at them. Turning to Durham, the result of the miners' vote upon the refusal of the coalowners to grant an advance of 15 per cent. in wages, demanded at the instance of the National Federation, was officially announced as follows: To work on, 19,704; to strike, 20,782—majority for striking, 1078. As, however, there was not a majority of two-thirds, the Executive Committee stated that, according to the rules, the men must work on as usual, though the coalowners had been given renewed notice of a request for an advance in wages. The refusal of the Northumberland miners either to strike or to assist those on strike was also officially confirmed on Tuesday. Affairs in Scotland were very quiet. Mr. Robert Brown, the miners' agent of the Lothians, and six of the workmen met the General Manager of the Newbattle Collieries concerning the 20 per cent. advance demanded. This was unhesitatingly refused on behalf of the Lothian Coal Company. The Newbattle Collieries, which are the largest in Mid-Lothian, are not in the Masters' Association. The result was a great surprise, as it was generally anticipated that the advance would be conceded. On the same day, the Executive Board of the Fife and Kinross Miners' Association sent a communication to the Coalowners' Association to the effect that they were prepared to recommend the miners to accept a 12½ per cent. advance in wages, on the condition that the men were allowed to work on day notices until a further increase was granted.

Wednesday disclosed an increased disposition on the part of the men in South Wales to resume work under the conditions of the sliding-scale—indeed it was estimated that about 45 per cent. of the men were returning to work. In some quarters it was thought that the men were going back simply with the view of coming out again at a more convenient season, when they will be organized, and have more funds at their back. From Cardiff it was reported that the docks were

full of vessels, which could not leave port for want of coal; that the men were performing the most absurd and aimless marches, and holding mass meetings at which no business was done; and that there were still 1200 troops in the district. In the upper portion of the Aberdare Valley, things had by this time assumed their normal aspect; and news came to hand that the Ferndale and Clydach colliers had resolved to resume work. A meeting of the executive of the Yorkshire Miners' Association was held on the same day. Subsequently, Mr. Pickard, M.P., the President of the Miners' Federation, said he had received a telegram informing him that the coal depôts abroad showed signs of exhaustion. Gibraltar was cleared out; and Port Said had only three weeks' stock. If, he said, the South Wales men had any courage left, they would stick to the strike. A meeting of representatives of the Cumberland coal miners was also held at Maryport, to receive reports from the various lodges in the district. The main question for decision was whether the men who had re-commenced work at an advance of 10 per cent. should discontinue working at a day's notice, and remain out until a settlement is come to between the Miners' Federation and the Midland coalowners, or should continue working and advise the men at Whitehaven to follow their example. It was decided by a small majority to remain at work at the present rate of wages, and to recommend the Whitehaven men to accept the same terms. In the Leicestershire and South Derbyshire districts and elsewhere, much distress prevailed; and many families were said to be in a state bordering on starvation. Regarding Scotland, a conference was held in Edinburgh between representatives of the masters and men in the Lothians, at which was discussed the demand for a further advance of 20 per cent. in wages. The men claimed that the increase had been conceded in the western districts; but the masters contended that the rise in the price of coal did not justify the increase asked, and suggested that the matter should be referred to arbitration. The men refused this. The Fife Coalowners' Association rejected the terms submitted to them on the previous day by the representatives of the miners; but they intimated their willingness to have a conference with the men for explanations if they desired it.

On all hands there was further evidence on Thursday that the strike was fast collapsing. On that day it was computed that, in South Wales and Monmouthshire, there were at least 60,000 miners working; and the strikers had dropped into a minority. The Emergency Committee of the Monmouthshire and South Wales Coal Owners' Association also published a statement to the effect that collieries producing half the assured output of the Association were at work. A demonstration, which was attended by less than 2000 men, was held at Merthyr, at which "stern" protests were made against the imprisonment of four persons who were members of the Old National Colliery Workmen's Committee, and who were committed for 28 days by his Honour Judge Williams on the 16th ult., for, it was alleged, "upholding the rights of the workmen." It was also resolved to convene a meeting on Saturday, at the Rocking-Stone, near Pontypridd, for the purpose of ensuring that future action should be unanimous. Other meetings were held on that day. The workmen of the Pentre, Tynybedw, and the Gelli steam and house coal collieries assembled; and it was generally conceded that there was not sufficient reason to prolong the strike. By a large majority, they resolved to demand 8¾ per cent. advance in addition to the 1¼ per cent. increase that was awarded by the last audit; and a deputation was appointed to convey the resolution to Messrs. Cory Bros., of Cardiff. As far as the Aberavon district is concerned, the strike was declared to be at an end. The speech which was made by Mr. Ben Tillett at the Pontypridd meeting on Monday, does not appear to have met with general approbation; for at a meeting of the Cambrian Miners' Association, representing 24,000 miners, it was characterized as "inflammatory and ill-advised." It was considered that it contained a number of gross, misleading, and inaccurate statements concerning the sliding-scale; and the whole harangue was put down as an insult to Welsh miners. The strike of miners in certain districts of South Yorkshire and North Derbyshire was marked on Thursday by riots, and, late on Wednesday night, by a diabolical outrage at the Hornthorpes Colliery of Messrs. J. and G. Wells and Co., Limited. About 300 men marched to the place, and attempted unsuccessfully to fire the timber stacks. They then liberated two waggons filled with slack, which ran on to the Midland line and were completely smashed. Collision with a goods train as well as an excursion train was very narrowly averted. In Leicestershire and Notts, where there are upwards of 22,000 colliers on strike, the Union funds were reported all but exhausted. There are nearly 17,000 members of the Union in the Notts coal-fields; and of the £16,000 which they had in funds at the beginning of the strike, £14,000 has already been absorbed in strike pay. In Scotland, the Mid and East Lothian miners determined to adhere to their claim for a 20 per cent. advance in wages; and they announced their intention to cease work after Monday. The Midland Railway Company reported that the decline in their coal traffic is enormous; and several hundred of their men had thus been partially or entirely thrown out of work.

There was marked quietude in all districts on Friday. The two most noticeable events in South Wales were, first, an intimation by Messrs. Cory Bros. to the Emergency Committee of the Colliery Owners' Association of their intention not to comply with the demands of the hauliers for an advance at once of 8¾ per cent. in addition to the 1¼ per cent. added to their wages by the sliding-scale audit; and, secondly, the stoppage, by the police and military, of a procession which was on the road to Ferndale with the object of holding a mass meeting there. The Ferndale colliers had only then been at work two days; and it was their request to be protected from the procession which led the authorities to take this action. Reports showed that at the collieries where work had been restarted, there was a daily increasing number of men seeking employment; and that several of the smaller pits were also recommencing work. As to North Staffordshire, the colliers expressed their desire to resume work at the old rate of wages; but a strong feeling prevailed among the colliery proprietors that, as they have suffered much loss from the past two weeks of enforced idleness, a reduction in wages must be demanded. It was arranged that representatives of the masters and men should meet in conference on the subject on Monday (yesterday). Most of the pottery manufacturers have exhausted their stocks of coal; and, with a few exceptions, the works are to be closed for a time. This step will affect about 30,000 hands engaged in the pottery trade. The ironworks of North Staffordshire are at a complete standstill. More than 4000 men have also been thrown out of work at Widnes by the strike; and much distress is the result. On the same day, the Secretary of the Barnsley Chamber of Commerce received a letter from the President of the Board of Trade, replying to a resolution suggesting that he should offer himself as mediator in the coal dispute. Mr. Mundella stated that he would give the matter his serious consideration. Lord Compton, replying to the same resolution, did not see that the President of the Board of Trade could interfere, even with offers of mediation.

Saturday ended the fourth week of the strike in South Wales, and, it is to be hoped, this great struggle between the masters and men of the district. As arranged on Thursday, the miners still out assembled in great numbers round the Rocking Stone. Several speakers condemned the sliding-scale, and declared that it was more in favour of the masters than the men; and a resolution was proposed calling upon the working men's representatives on the Sliding-Scale Committee to resign, directing the Rocking Stone Select Committee to devise a mode of regulating wages more beneficial to workmen, and pledging those present not to contribute any more to the Sliding-Scale Committee. The proposal was received with great favour, and was passed unanimously. A resolution calling for the establishment of a labour organ was also passed. A third resolution pledging the meeting to join the South Wales and Monmouthshire branch of the Miners' Federation was carried with a few dissentients. The meeting then discussed the proposal to resume work on Tuesday. Wide divergence of opinion was evident, counter resolutions to stand out until the hauliers were paid, and another calling for the renewal of a general strike for an advance, being proposed. Ultimately, on the question of resuming, it was decided not to go back till the hauliers were paid, all the summonses withdrawn, and the expenses connected therewith paid by the masters. A deputation was appointed to wait on the Emergency Committee on Monday to lay the demands before them. If these are conceded, work will be recommenced on Tuesday; if not, the deputation will convene another mass meeting at Pontypridd. The men employed at the extensive Clydach Vale Collieries, by an immense majority, decided to resume work. In regard to other districts, we learn that the funds of the Leicestershire Union are rapidly disappearing, and only £2000 was available for the Notts miners last week, with the result that the men only received half-pay. On Saturday about 4000 miners of the Leeds district met on Hunslet Moor, and unanimously passed a resolution in favour of continuing the strike, and submitting to no reduction. It is stated that the Executive of the Miners' Federation have decided to take a ballot of the men upon three points: First, Will the men submit to the 25 per cent. reduction or any part thereof? Secondly, Will the men agree to the owners' offer of arbitration? Thirdly, Will the men allow those who can get the old rate of wages to resume work? The ballot will be declared before the 14th inst., on which day a conference of the Federation will be held at Nottingham. The Lothian miners have reversed their decision of Thursday, and work was continued yesterday.

A little temporary difficulty was created at Newport on Wednesday by the Union officials as to the unloading of some cannel coal brought from Scotland for the Newport (Mon.) Gas Company. It appears that, believing the coal had been conveyed there expressly to supplant the supply hitherto obtained locally, they issued orders that the cargoes were not to be touched. But on its being represented to them that cannel coal had always been brought either coastwise or by rail, they admitted the justness of the position; and on Thursday the dockers began to discharge the ships. The Company have a stock of coal in hand sufficient for a month's supply of gas at the present rate of consumption.

The Finances of the Blackpool Corporation Gas Department.—The Borough Treasurer for Blackpool has issued his annual statement of accounts. The gas revenue account shows receipts to the amount of £34,337, and a profit of £5335, or £1025 more than last year. The gas made was 209 million cubic feet—an increase of 7 per cent. on the preceding year. The quantity of coal carbonized was 21,500 tons. The net capital outlay on the gas undertaking for the year was £12,599, chiefly on mains, meters, and lamps. At the end of the financial year, there were 40 miles of mains, 1412 street lamps, and 5100 consumers.

Illegal Use of Water.—At the Widnes Petty Sessions, on the 26th ult., six persons were summoned, at the instance of the Widnes Corporation, for illegally using water. In the first case, Alfred Clarke, of Upton, was summoned for unlawfuly allowing one William Wood to take water for domestic purposes without the consent of the Corporation. Wood was the occupier of a cottage of which the defendant was the agent. There was no water supply to the cottage, and Wood fetched water from defendant's house, which was 50 yards distant. In this way payment of the water-rate (14s. 8d. per annum) was avoided. Defendant's wife said application to have the water put in was made some years ago; and witnesses for the Corporation admitted that they had known for years that there was no water supply to the cottage, and that negotiations about it had been carried on between the defendant and Wood. The Bench thought the Corporation had been very remiss; and they imposed a fine of 1s. only and costs. In five other cases, consumers were summoned for using water for trade purposes, in laundries, while paying only for a domestic supply. One admitted that he had carried on the business for 22 years; but he said he thought the landlord paid all the rates, including the water-rent. The fine in his case was 20s. and costs. The other defendants were fined 2s. 6d. and costs, except one, who was fined 10s. and costs. In answer to the Magistrates, Mr. Whitfield, rate-collector for the Corporation, said the rate was not fixed on the size of the laundry, but on the assessment of the house. A person could rent a small cottage, and put up a dozen wooden sheds, and then the water-rate would be small. The Chairman remarked that means ought to be taken to let the people know that they were offending. Some of them had been summoned because they did not know they had to pay. It was stated that notices were posted five or six years ago, and others were about to be issued.

PORTSMOUTH TOWN COUNCIL AND THE WATER-WORKS.

Rejection of the Proposal to Purchase.

At the Meeting of the Portsmouth Town Council last Tuesday—the MAYOR (Alderman R. Barnes) presiding—the Committee specially appointed to consider the suggested acquisition of the water-works by the Corporation presented an exhaustive report on the financial aspect of the question. This proposal has been commented upon on previous occasions in our article on "Water and Sanitary Affairs;" and further reference to it appears under that heading to-day.

From the report it appeared that several interviews had taken place between the Directors and the Committee; and, as the result, the latter came to the conclusion that the only basis on which it would be possible to arrive at an arrangement would be that of providing for the shareholders an equal income to that derived from the dividends on the shares held by them, by the issue of a corresponding amount of Corporation stock. Proceeding, they stated that the present total dividend on the several classes of shares was £27,450 per annum; and to produce a similar sum by the dividends on 3 per cent. stock would require an amount of stock which at its nominal value would represent £915,000. Then the debenture debt of £101,250 would have to be taken over and paid off as the debentures matured; and as this debt carried a higher rate of interest than 3 per cent., they considered it would be better to raise the necessary amount by the issue of Corporation stock, as this could probably be done at or about par, and discharge the debentures as they became payable. Supposing it could be issued at par, the amount of stock to be raised would be, of course, £101,250. For the purpose of compensating the Directors and some of the officers a sum of £14,000 had been arrived at; and assuming this could be raised by Corporation stock at or about par, a further £14,000 stock would have to be issued. Therefore a total sum of about £1,030,250 stock would be required. In addition, there would be the expenses incurred in promoting a Bill in Parliament, and in the issue of the stock; so that probably the actual stock which would have to be created would be £1,036,000. The dividend on this would be £31,080; and assuming power was obtained to extend the repayment of this sum of stock over 80 years, the Committee estimated that the amount required for interest and redemption of principal would be £34,306 per annum. But if power could be obtained to extend the repayment over 100 years, the annual sum needed would be £32,785. The net annual income of the Company in the year ending March last was £30,440; but to this had to be added certain annual payments which would be saved—viz., Directors' fees, £840; Secretary's salary, £500; and Consulting Engineer's salary and commission, £500—making the total net annual income £32,280. The average net increase of annual income for the past three years had been about £600; and the Committee remarked, if this increase could be maintained, the net income would in a few years be materially augmented. From the figures given, it would be seen that, assuming 80 years were allowed for the redemption of the stock created, the present income, which on the transfer of the undertaking would be immediately available, would not be sufficient by about £2026 to meet the charge for interest and redemption of capital. But if the present rate of increase in the annual income were maintained, the deficiency would soon be cleared off, and might be converted into a surplus. If, however, a longer term could be obtained for repayment, even at the outset the income available would be sufficient to meet the annual charge, and would, at the present rate of increase, almost at once produce a surplus. The Committee recommended that the report be approved, and the principle of purchasing on the basis indicated be adopted; also that they be authorized to arrange with the Directors of the Company a formal agreement for the sale of the undertaking.

Alderman FOSTER, in moving the adoption of the report, said the Committee had had this matter under consideration for about two years; and they believed they had obtained the best terms possible, and that they were fair. It was now some sixteen years ago since one of the members tried to induce the Council to purchase the undertaking. Of course, the property might then have been acquired at a much lower figure than now; but they could not then get the Directors to realize that they were earnest in the project, and the matter fell through. This circumstance involved a great loss to the inhabitants; and, as time went on, it became more and more apparent that the longer the negotiations for the purchase were delayed, the greater would be the loss to the public. He went on to show that the amount the Company had available for dividend in 1885 was £26,443; and for the past year it was £30,440. Between 1885 and 1890, something like £90,000 was spent in duplicating a considerable portion of the works, and so making the supply safe. The net income of the Company during the last eight years had been as follows: 1885, £26,443; 1886, £28,362; 1887, £30,820; 1888, £30,545; 1889, £29,247; 1890, £29,220; 1891, £29,239; and 1893, £30,440. He had mislaid the amount for the year 1892; but he believed it was about £30,000. He repeated many of the figures mentioned in the report; and then said that they were assured by the Directors that no fresh expenditure of capital would be required for some time to come. With regard to the desirability of acquiring the property, he pointed out that the purchase would benefit the town from a sanitary point of view; the profits would go to the relief of the rates; and the Council would have more complete control over the roads than at present.

Mr. M'ASKIE seconded the motion.

Mr. MILLER opposed the proposed purchase. At the present time, he observed, Portsmouth enjoyed an abundant supply of pure water; and if the Corporation acquired the undertaking, neither the quality nor the quantity could be improved, nor could the cost to the consumers be reduced. He regarded the demand of the Directors as extravagant; and he could not understand why the Corporation wanted to embark in this speculation.

Three other members spoke in opposition to the Committee's recommendations; and, on a division being taken, fourteen declared for the motion, and nineteen against it, so that it was negatived.

NOTTINGHAM CORPORATION WATER SUPPLY.

Annual Reports.

The report of the Water Committee of the Nottingham Corporation, and that of their Engineer (Mr. L. T. Godfrey Evans), for the year ending March 25 last have been published. The Committee state that the revenue has been £515 more, and the working expenses £1891 less, than in the previous year. After paying the annuities and interest on loans and consolidated stock, and the annual contributions to the renewal fund and the different sinking funds, the ultimate balance of profits available for disposal by the Council in aid of the rates or otherwise as they may see fit, amounts to £3634. In his report, Mr. Evans remarks that the whole of the works and grounds of the undertaking are in a sound and satisfactory state. The pumping statistics for the year are of a most satisfactory nature; the total from all sources being 1925 million gallons, as against 1972 millions in the preceding year, which is 37 million gallons below the average for the last seven years, and 112 million gallons below the maximum quantity pumped during the same period, and ranks with the year 1889 as being the lowest since 1885. This diminution in the supply is more satisfactory than at first sight appears, as the usual increase in the domestic and trade supplies has taken place, and is the result of the vigilance and efficiency of the staff in looking after waste, &c. Owing to the diminution in quantity of the supply from Bestwood, certain extensions of the underground headings and bore-holes are being carried out for the purpose of increasing its yield to at least double the present volume. The other matter of importance during the year has been in taking weekly observations in connection with a possible future extension, should increased demands on the undertaking require it. With this object, certain gaugings of springs and streams have been, and are still being taken; and the results carefully recorded for future reference. The extensions during the year have been of a limited character, as only three miles of main piping have been laid, and in all cases a fair interest on the outlay has been guaranteed. Burst mains in colliery districts still give trouble and anxiety; but in all cases the repairs have been executed promptly and efficiently. The year's record of inspections gives 48,614 houses visited, with 31,301 taps repaired, against 74,871 houses with 37,185 taps repaired in 1891-2. This apparent falling off in the work is, in reality, not so, as a great amount of the waste is discovered at night by external examination only; thus enabling the day inspector to go direct to the source of waste, and so save the necessity of going from house to house in the district visited by the night inspector. The number of houses in the water district is 59,119; and the population 245,343.

ARTESIAN WELLS.

At a recent Meeting of the Gorton East Branch of the Amalgamated Society of Engineers, Mr. W. H. BEASTOW, M.Inst.M.E., read a paper on the above subject. It was illustrated by a number of drawings, which added greatly to the interest of the facts presented. In the course of his remarks, the author said:

It is stated in Egyptian history that many wells existed in that country more than 4000 years ago, and were lined in their interior by brickwork; but the methods used in the sinking of these wells are at the present time entirely unknown. Some of them are round, and others square. The Jewish historians also mention various wells from which water was drawn in earthenware pots, by the use of ropes, for drinking and other purposes. One of the oldest and most celebrated wells in the world is the one known as the well of Memrem at Mecca; and it dates, according to popular tradition, from the most remote antiquity—being venerated as the well from which Hagar nourished the ancestors of the Arabian people. It is believed to have been constructed by the patriarchs; but especially Abraham and his son Isaac are mentioned. Another very ancient well is the one called Jacob's Well, in Sychar, which has been visited by pilgrims in all ages. It is 9 feet in diameter, and 105 feet deep, and is made entirely through rock. When visited some years ago, it contained water 15 feet in depth. The next, so far as age is concerned, is the most remarkable well in existence. It is situated at Cairo, and is supposed to have been constructed by that remarkable man, Joseph, the son of Jacob, after he became ruler of Egypt. This well is known in history as Joseph's Well; and it is 300 feet deep. It is cut in the solid rock, which, it appears, was considered to be too deep for one single lift; and it is divided into two separate shafts of different sizes, with a compartment cut out of the rock near the middle of the entire depth—dividing the well into two separate shafts at a depth of 165 feet below the surface of the ground, large enough for oxen to work in for the purpose of raising the water from the bottom to the surface. The upper shaft has a section of an oval form, 24 feet by 18 feet, with a spiral passage cut out of the rock, 6 ft. 4 in wide by 7 ft. 2 in. high, winding round it from the surface to the chamber below the first shaft, through which oxen and men riding on the backs of asses pass by a very gentle slope of the floor. The lower shaft is also oval, and 132 feet deep below the working chamber before named; but it is not constructed in the same vertical line so far as its centre is concerned, but a little on one side, and its dimensions are 15 feet by 9 feet only. The oxen working in the chamber lying between the two shafts lift the water from the bottom of the lower shaft by the use of a chain of pots into a reservoir at the bottom of the upper shaft, through which shaft the water is again lifted to the surface by another chain of pots similar to those used in the bottom shaft. The chains of pots work over pulleys fixed at the bottom, middle, and top of the well, and are what are to-day called a system of endless chains. There are in the inner sides of the upper shaft a number of semicircular openings used for the purpose of lighting the interior of the winding passage before named. There are also in Egypt what we now call artesian wells, very ancient, sunk to 60 or 80 yards in depth through the soil, clay, and marl

down to the limestone rock, into which holes from 4 to 8 inches in diameter have been bored; causing water to spring through these holes, and partially fill the wells. In many places in the East there are the remains of aqueducts for conveying water from a higher level where the springs existed to a lower level where the water was required to be used, which are of great antiquity both in Egypt and many parts of Syria. Some near Jerusalem and Tyre are attributed to Solomon, who flourished 1000 years before the Christian Era.

The obtaining of water for domestic purposes and irrigation must have cost the Ancients a great amount of labour, as, for instance, in Peru, where one aqueduct existed 450 miles in length, for the purpose of conveying water from certain springs near the summit of a mountain, at the distance named from where it was required, to water a tract of country 50 miles wide. Another Peruvian aqueduct was 360 miles in length, and watered a vast extent of country. There are also a considerable number of aqueducts which were caused to be constructed by the Emperors of Rome, not only at Rome, but at Constantinople and in ancient Gaul, which are ruined monuments to the skill of hydraulic engineers of the ancient world, as systems of providing water from springs at a distance for the use of the cities of those days.

The country in which artesian wells of ancient date have been greatly used is China, where thousands of bore-holes, from 6 to 8 inches in diameter, have been excavated in rocks to a depth of from 1500 feet to 2000 feet, extending over an area of 450 square miles. Some engineers are of opinion that many of these holes are not less than 3000 feet deep; and from them water can still be obtained—flowing from the holes over the surface of the land. What may be termed the modern artesian wells were commenced in France—the first one in the year 1126, or nearly seven and a half centuries ago. But the most remarkable one was completed at Grenelle (Paris), in 1841. After many great difficulties had been met with and successfully overcome, it reached the great depth of 1802 feet; passing through about 1400 feet of chalk, and then into clay and greensand to another depth of 186 feet, when a large quantity of water was obtained, which flowed over the surface of the ground. Numerous borings had previously been executed at Artoise, from which district the wells obtained the name by which they are still known and spoken of.

A great number of artesian wells have been, and are still being made in England in the stratified rocks and other formations; and a supply of water is generally obtained therefrom. A well was bored at Southampton to a depth of 1300 feet, at a cost of £10 per foot; but the boring has been discontinued. Another one in Manchester, into the new red sandstone, was discontinued by a firm who expected to obtain a plentiful supply of water, but failed to do so; and the bore-hole was abandoned until the owners of the premises consulted a gentleman about his system of obtaining water from artesian wells, when he undertook to produce an adequate supply from the same bore-hole that had been abandoned. In a few weeks he obtained a constant flow of about 6000 gallons of water per hour, which enabled the firm to dispense with the use of the town service. The system is still in operation, and the supply satisfactory and continuous. Many other artesian wells in various parts of the country, which had been abandoned in a similar manner, are now producing an abundance of water. The supply of good, clear water from these artesian wells ranges from 6000 to 30,000 gallons per hour; and about 100 of them, bored to a diameter of 12 and 16 inches, are now at work on this improved system.

The author next gave a detailed description of Mr. Chapman's system of boring for water; and then, in answer to questions, furnished some particulars as to the Gorton (Manchester) pumping-station. It was commenced in 1845, and completed in 1849. The well is twelve feet in diameter; its depth is 212 feet; and from the bottom galleries are driven in different directions. The strata passed were clay and sand for about 131 feet before reaching the red rock. Before coming to the rock, a great quantity of water issued from the granite; but after the rock had been reached, the amount yielded increased as the depth became greater. The water was pumped out during the sinking, and the excavated material raised by an engine of some 25-horse power, until the water was more than the engine could raise. When this occurred, the well had been sunk 194 feet; and further sinking was suspended until a new and more powerful engine was erected. This was a beautiful self-acting condensing engine of 160 nominal horse power. They commenced working in 1847, and continued until 1851; after which time the engine was only used in periods of emergency. The total cost of the well, engine, buildings, and all attendant expenses, was about £20,300.

WATER SUPPLY WORKS IN ITALY.

A recent number of our contemporary *Industries and Iron* contained the following particulars on the above subject:—

Leghorn is at present supplied exclusively with spring water. It is brought from the Livornese Hills—a distance of 10 miles—by means of an aqueduct, and is impounded in the city in two large covered reservoirs. The water is not laid on in any of the houses, but is conveyed by water-carriers from the public fountains, and supplied to residents in wooden barrels containing 3½ gallons, at a cost of about 1s. 6d. per 100 gallons. This is in no sense a municipal water-rate, but simply a charge made by the water-carriers for porterage. The water is free to those who choose to help themselves to it. The quality of the water is excellent; but, unfortunately, the supply is insufficient, especially in the summer. The present aqueduct was commenced at the end of last century, when the population of the city was only 30,000, as against 100,000 at the present day.

In 1884, two Italian engineers obtained a Royal decree granting them a concession to supply Leghorn with water on the terms of a scheme which they had submitted; and this concession has been subsequently acquired by an English firm. According to a recent official report, it is proposed to impound in a large artificial lake the waters of two considerable mountain torrents. This lake, or reservoir, will be formed by the Savolano Valley, which is situated in the same hydrographic basin as the Colognole Springs, which now furnish Leghorn with water. It will have a superficial area of something like 203,000 square yards, and an average depth of 80 feet. The situation is at an altitude of 460 feet above the sea-level. The water is to be brought to Leghorn by means of pipes running parallel with the existing aqueduct; and it is estimated that the city will be supplied with 22½ gallons per second. The height at which the lake is situated will give sufficient hydraulic pressure for all industrial purposes. The water will be laid on directly in the houses. The Company which will be formed to work this enterprise will be on the ordinary footing of a water company; the inhabitants having liberty to accept or reject the water.

This scheme, however, is said to be regarded unfavourably by some of the local authorities, and this chiefly on supposed hygienic and scientific grounds. Throughout Italy there exists a strong prejudice in favour of spring water, and a great antipathy to the idea of drinking water which has been impounded in open reservoirs. The present Leghorn supply rises under cover, it flows to the city under cover, and is there impounded under cover; while the proposed supply will be impounded in an open reservoir, and will be principally composed of rain water. The English Company are at present making a special effort to push the project; but it will have much to do to break down the local prejudice in favour of spring water.

The Brindisi Municipality, with a view to improve the sanitary condition of the town, have for some time past had under consideration various projects to secure a sufficiently abundant water supply. In ancient times, Brindisi had an ample supply of water, which was conveyed to the town from a distance by a system of aqueducts. These conduits have gradually fallen out of repair In drawing up the plans referred to, it was desired, where possible, to make use of the existing works by repairing and rebuilding where necessary; the water at the sources from which the aqueducts led being as abundant and as good as ever. At present Brindisi is mainly dependent for water on the limited quantity brought to the town through the nearest part of the aqueduct, which conveys about 249 cubic metres of water (equal to 55,000 gallons) daily. This is conducted to three public fountains, where the inhabitants obtain their supplies. In addition to this, the better class of houses have under their basements cisterns in which rain water is stored. This and wells of brackish water constitute the present water supply of Brindisi.

Surveys have been effected by an engineer of the Societá Italiana per Condotte d'Acqua of Rome, and two definite projects have been drawn up, both having in view the utilization of part or all of the Roman aqueducts remaining, by thoroughly cleaning and repairing them from the town right up to the water sources. The first project, which provides for a daily supply of from 30 litres to 40 litres per head of the population (estimated at about 20,000), is divided into three alternative sub-plans. The second embraces the whole of the aqueducts, and would give a daily yield of 64 litres per head of the population. Common to both projects is a cistern or reservoir to be constructed at the highest point of the town, of the capacity of 1,000,000 litres; from which water-pipes would lead to the principal points of distribution through public fountains. The three alternative sub-plans would, it is estimated, cost £37,467, £45,671, and £28,243; and the second project would entail an outlay of £52,848. According to a recent official report, the Municipality are now desirous of treating for the concession of the works in question, on the basis of the concessionaire undertaking the construction at his own cost, and subsequently administering the supply for a given number of years—recouping himself by means of a water-rate to be levied on the consumption of water; the works eventually to revert to the town.

Scarcity of Water at Leeds.—At a special meeting of the Leeds Corporation Water Committee last Wednesday, it was reported that there was only 31 days' supply of water for the city in the reservoirs. Never since the Washburn valley gravitation scheme came into operation, which was in 1867, has the storeage been so low; and it is to be regretted that the repairs now going on at the Eccup reservoir necessitate it being kept empty. Had it been available for storeage purposes, the drought would have been a matter of little moment. In the Fewston reservoir, there are now 86 million gallons of water, as compared with 787 millions in August last year; in the Swinsty storeage and compensation reservoir, there are 470 million gallons, compared with 895 millions; and in the storeage and compensation reservoir at Lindley Wood, the depth shows 162 million gallons of water, as against 618 millions. While there is now only about thirty days' supply in store, there was, at the end of August last year, a sufficient quantity of water to meet the requirements of the inhabitants for 104 days. The Committee decided to at once cease watering the streets, and to cut off the supply entirely from 8 p.m. to 5 a.m. daily.

The Recent Electric Lighting Failures at Hastings.—In our issue for Aug. 22, allusion was made to certain very bad failures of the electric light at Hastings; and we since learn from a local paper that it is no uncommon occurrence to find some of the large electric lamps on the front line in darkness or comparative darkness despite the somewhat frequent protests of the Lighting Committee of the Town Council. Certain of the leading tradespeople have also had reason to complain of a similar state of things at their establishments. The entire front line of the borough was to have been lighted, in accordance with a contract made between the Corporation and the Electric Lighting Company, by electricity in October next; but now the Company have expressed their inability to carry out the terms of the contract until March next—six months later. Our local contemporary does not know that "the ratepayers need complain of this alteration, since they will have the satisfaction to know that the splended Whitehall lamps supplied by the Gas Company, and which can be relied on to give a steady and continuous light, will be available for the dark and dreary nights of next winter season. The management of the Electric Lighting Company are understood to be carrying out some material and extensive improvements in their system; and the sooner these are completed the better, if they are to retain the confidence of the public. Meanwhile the Lighting Committee of the Town Council should be in no hurry to get rid of the Whitehall lamps, or the inhabitants may some dark evening find the front line of the borough to be presenting anything but an attractive appearance."

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Scotland has, though not to the same extent as England and Wales, been affected by the agitation in the coal trade. The leaders of the men have striven to their utmost to get them to strike, but the men have not implicitly followed; and the result is likely to be better for the workmen. There is one great obstacle to united action among the men, in the fact that Scotland is divided into three districts—the West; Fife, Clackmannan, and Kinross; and the Lothians—and that in each their funds are separate. Thus there is in the Fife district a considerable fund; and its existence has prevented any sort of amalgamation with the West, where there are next to no funds. The consequence was that, when it was thought that the West was going to strike on account of the masters having refused an advance of 2s. per day, and offered 1s., the Fife men resolved to come out, and did so in the beginning of last week, on the ground that they were entitled to a 25 per cent. rise instead of the 12½ per cent. which the masters were willing to give. Having got the Fife men out, the men of the West at once agreed to accept the offer of the masters, and set to work an extra day a week. Alarm consequently spread among the Fife men; and the latest information is that a ballot is to be taken on Monday on the question of whether the masters' terms should not be accepted, and work at once resumed. There is no doubt that this will be done; and Fife will again share in the increased demand which has arisen in consequence of the strike in England. In this connection, it is instructive to observe how foolishly the men are led. The Lothians men had been refused an increase of 20 per cent., which they demanded because the wages in the West were higher than with them, and were offered 10 per cent. This did not satisfy them; and they sought a conference with their masters, which took place on Wednesday. The masters made the surprisingly generous offer to let the question whether there was anything to justify higher wages than were paid before July, 1892, go to arbitration, and to exclude contract prices from the arbitration. Even this fair offer was declined; and the men on Thursday resolved to strike. This was the leaders' advice—given though it was apparent that in England the strike was about played out, that in the West the miners were working, and that in Fife the men were wavering. The men blindly followed this advice on Thursday, and agreed to go through the form of a ballot on the question. They soon saw their folly; and to-day, when the ballot was taken, they voted by a majority in favour of accepting the 10 per cent. In order to cover their retreat, they have resolved to take another ballot on the question of whether they should accept arbitration. This they are likely to be too late for now, because their representatives out-and-out declined it at the conference, and there is every likelihood that the coal market will soon be easier. There is also the further probability that, when the Englishmen are all back to work, the price of coal will come greatly down; and then the masters will be wanting to reduce wages, which would lead to negotiations in connection with which another arbitration would be necessary. Meanwhile, the struggle has not lasted so long as to exhaust stocks; and while those who were not under contract have had to pay increased prices, so far as I am aware there has been little inconvenience to large users of coal in consequence of irregularities of delivery.

The installation of the Peebles process of oil-gas making which has been fitted up in the works of the Kelso Gas Company has now been in use for some time, and is giving the utmost satisfaction. As at Galashiels, the heat used for the oil-retorts is the waste heat of the coal-oven adjoining—the draught being so regulated that the lower heat which is necessary for the oil-gas making is easily obtained. By the introduction of the oil process, the gas has been enriched from 29 to 32 candles; and as the price was recently reduced from 5s. to 4s. 2d. per 1000 cubic feet, consumers are getting the benefit of an improved gas at a cost nearly 17 per cent. lower than formerly.

In consequence, it is stated, of air being admitted to the gas-mains, part of the town of Renfrew was last Saturday night for some time thrown into darkness.

On Monday afternoon the Kelvinside Electricity Company, which has been formed to supply electric lighting to a portion of the west-end of Glasgow, turned on their current. The station and plant have cost about £17,000. At present, provision is made for supplying 3000 lamps of 10-candle or 2000 of 16-candle power; but the generating plant can be extended to provide light for three times the present capacity. There are over 10,000 yards of distributing cables, which have been laid in the ground direct. The Corporation are prohibited from competing with the Company in their area; but they have the right of purchasing the undertaking. It is significant of the attitude of the Corporation towards the undertaking—which, I suppose, they regard as something of the nature of a "pirate"—that not a single member of the Town Council or Police Commission took part in the opening ceremony.

The Marchioness of Tweeddale on Tuesday turned on the new water supply which the Corporation of Haddington have introduced from Longyester, upon his lordship's estate. The town, prior to 1874, depended upon wells for its water; but in that year a supply was brought in from Chesters, upon the estate of the Earl of Wemyss. The supply is a direct one, without storeage; and though the calculated quantity is 100,000 gallons a day, to a population of about 4000, in dry seasons it falls to 80,000 gallons a day. The higher parts of the town are consequently frequently left without water. The new supply will yield 128,000 gallons a day. It is derived from springs, which are situated 450 feet above the main street of the burgh; and a cistern to break the pressure has now been introduced at a height of 280 feet. The cost of the works has been £6000, which will entail an assessment of about 6d. per pound. Messrs. Leslie and Reid, of Edinburgh, were the Engineers. The ceremony of turning on was performed by her ladyship with a silver key, the gift of the Engineers. The Contractors (Messrs. Cochrane, Grove, and Co., of Middlesbrough) presented Provost Brook with a silver cup, out of which the newly-introduced water was quaffed. The proceedings were wound up with a banquet.

There is now quite a plethora of institutes dealing with sanitary matters, of which not the least important is the National Council for the Registration of Plumbers, the fourth annual congress of which was held this week in Aberdeen. At the congress, encouraging reports were given as to the work of instructing plumbers, and as to the registration movement, which is spreading. Professor Matthew Hay, of Aberdeen, was the President. The registration movement was originated by the Plumbers Company of London, of which Sir Stuart Knill, the Lord Mayor, is Master; and the congress was graced by his Lordship's presence. This was his Lordship's second visit to Scotland within a few weeks to attend congresses upon sanitary matters; the first being that of the British Institute of Public Health, which was held in Edinburgh last month.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 2.

Sulphate of Ammonia.—A sudden change has come over the market; and the upward movement has received a check. A reaction was, of course, to be expected sooner or later. But there does not seem sufficient cause for it at the present moment; and the revulsion of feeling appears based more upon sentiment than on facts. For the present at all events, stocks are far too small to have any influence upon the market; and the production will not materially increase till towards the end of the month. Therefore the low quotations now being made have nothing serious in them; and, unless circumstances change considerably, the market must remain steady during the greater part of September. To-day's prices are given as £14 15s. All September delivery is quoted a little less; and there are evidently a few second-hand parcels pressed for disposal. For future delivery, too, the feeling is less strong.

LONDON, *Sept.* 2.

Tar Products.—There is a little more inquiry for benzol; but the value does not improve. Solvent naphtha is moving off somewhat more freely at current rates. Tar acids have not attained a higher value, notwithstanding the outbreak of cholera in all directions on the Continent. Pitch is firmer, and slightly higher prices are being asked. Business during the week has been marked at the following rates: Tar, 11s. 6d. to 13s. 6d. Pitch, 24s. to 25s. Benzols, 90's and 50's, 1s. 5½d.; Creosote salts, 16s. Creosote, 1¼d. Solvent naphtha, 1s. 1d. Toluol, 1s. 4d. Crude benzol naphtha, 30 per cent., 6¾d. Carbolic acid, 60's, 1s. 6d.; crystals, 6½d. Cresol, 1s. 6d. Anthracene, nominal, 30 per cent., "A," 1s. 1d.; "B," 9d.

Sulphate of Ammonia.—Persistent efforts continue to be made to break the "boom" in this article. The rise has certainly been very remarkable; but it must not be forgotten that the low price at which sulphate was sold last year was both unbusinesslike and unreasonable, taking into account its nitrogen parity value with nitrate of soda. If makers are discreet, to-day's value will be maintained. Considerable business has been done at £15; while £13 10s. can be obtained for October to March delivery. The lessened production in Scotland, owing to the coal strike and the damping down of furnaces, may seriously affect the supplies of this market. Gas liquor is quoted at 9s. 6d. to 10s. 6d. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Stocks are gradually becoming exhausted, with no prospect of any immediate settlement of the wages dispute; but there is still an absence of any exceptional pressure of demand. The better qualities of round coal continue in extremely limited request for house-fire purposes; and prices for these practically remain quite stationary, at about 15s. to 16s. and 17s. per ton at the pit mouth. Any scarcity of supplies is chiefly felt in the lower descriptions of coal, and fuel for steam, forge, and general manufacturing purposes, as, although there are still some fairly large stocks held at a good many of the pits, these consist chiefly of the better qualities of round coal, and users for general manufacturing purposes are in many cases being compelled to resort to these to cover their requirements. For steam and forge purposes, through-and-through coal is now about the only class of fuel obtainable; and for this prices have been tending upwards, from 13s. 6d. to 14s. 6d. being readily got at the pit mouth. For engine purposes, slack is extremely scarce; and prices have further advanced. There is very little offering in the market, even in the commonest sorts, at under 11s. to 11s. 6d. per ton, the better descriptions fetching 12s. 6d. to 13s. per ton at the pit mouth. The general anticipation is that there is not much likelihood of the pits getting into work again before the end of the present month; and in the meantime consumers, where they are cut off from local supplies, are in some cases covering their requirements with coal which is obtainable from other districts where the pits are working. Durham coal especially is offered here at what may be regarded as fairly low figures. The shipping trade is only moderate, so far as Lancashire coal is concerned, as supplies from Scotland are being delivered alongside vessels in the Mersey at under the prices which have been quoted by Lancashire colliery owners, who are holding out for 15s. 6d. and 16s. per ton as the minimum for delivery at Garston Docks or the High Level, Liverpool; and these figures have been difficult to obtain.

Northern Coal Trade.—The coal trade of the North-east has been decidedly easier now that the miners in South Wales are so generally resuming work, and that Cumberland has decided not to strike, despite the resolution of the Midland Federation with which it is associated. The effect of this is seen in the lower range of prices, for best steam and bunker coals especially. Best Northumbrian steam coals are in very great demand; and the pits are working fully, so that there is a large output and heavy shipments. The tendency of prices is downwards. Best steam coals are quoted about 12s. per ton f.o.b.; second-class coal being generally 1s. per ton lower. Small steam coal is quiet, at from 5s. to 5s. 6d. per ton, with tolerably heavy shipments. Manufacturing coal is steady, with a rather better demand from some outside places. In gas coals, the alterations are not so marked. The shipments are maintained; and there is now a larger local use of coals, though the average of the year is not yet attained.

Deliveries are mainly on old contracts; and the price of these is generally about 6s. to 7s. per ton f.o.b., though sales of odd cargoes continue to be made at much higher prices. The demand for smithy coal is steady. Coke is firm, at about 16s. to 17s. per ton for best Durham qualities for export. The demand from the local furnaces is steady; and prices are unchanged. Gas coke is being produced in larger quantities; and some stocks are increasing at the works. There is no alteration in prices.

Scotch Coal Trade.—On account of the existence of the struggle in the coal industry, the demand for Scotch coal has continued; and in the west it has been so great that the arrangements for shipping were unequal to provide for it. Of course, any orders which are being given out at the present time are simply for immediate delivery. Forward contracting, in view of the certain fall in prices after the strike is over, is out of the question. The Fifeshire miners are about to resume work; and the Lothian men, though they resolved at a mass meeting on Thursday to strike on Monday, have, by ballot, reversed that resolution. Consequently, the whole of the miners in Scotland will be at work next week, endeavouring to earn what they can while the high prices last. This week the prices quoted are: Main, 9s. to 9s. 6d. per ton; ell, 10s. 3d. to 10s. 9d.; splint, 10s. to 10s. 6d.; and steam, 11s. 6d. to 12s. 6d., f.o.b. Glasgow. These quotations are, however, not very reliable. The shipments for the week amounted to 165,111 tons—a decrease as compared with the preceding six days of 9542 tons, and, as compared with the corresponding week of last year, of 90 tons. There was an increase at the western ports of 22,633 tons over the preceding week; but in the east there was a decrease of 32,175 tons. For the year to date, the total shipments have been 4,504,520 tons—a decrease, when compared with the corresponding period of last year, of 370,421 tons.

Incorporation of Brighouse.—A charter has been granted for the incorporation of the borough of Brighouse. The new borough comprises the Local Board districts of Brighouse and Rastrick, and the rural district of Hove Edge. The election of the first Town Council is to take place on the 1st of November next.

Accrington Gas and Water Works Purchase.—At an extraordinary general meeting of the shareholders of the Accrington Gas and Water Company on Monday last week, a resolution was unanimously passed approving of the sale of the undertaking to the Corporation and the four surrounding Local Boards, in accordance with the agreement arrived at before the House of Commons Committee, and embodied in the Bill now before Parliament.

Accident at the Oundle Water-Works.—The inhabitants of Oundle (Northamptonshire) have been temporarily deprived of their water supply, in consequence of an extraordinary accident to the water-works which have recently been erected at a cost of £10,000. A few days ago the flooring on which the engine and fittings had been erected sank into the earth a considerable depth, cutting the water-main in two and stopping the supply.

Auxiliary Water Supply for Rhyl.—Under the advice of Mr. G. F. Deacon, the Rhyl Improvement Commissioners have determined to obtain an additional supply of water for the town from the River Elwy; and they have authorized the Gas and Water Committee to purchase forthwith the requisite plant. Mr. Wright, of Chester, who was one of Mr. Deacon's assistants at Vyrnwy, has been temporarily engaged as Assistant Water Engineer.

The Employment of Electricity for Lighting and Motive Power at Blackpool.—Blackpool, which was one of the first towns in the country to use electricity as a means of propelling tramcars, as well as for lighting a portion of its extensive promenade, will, in the course of a few days, possess a complete installation of electricity for general purposes. Extensive plant has been put down in a building specially erected in Princess Street. The current was turned on for the first occasion last Thursday evening—an effort having been made to have at least one section of the installation at work before September. A 100 horse-power engine was accordingly set at work; and many of the principal places of business, together with one large pleasure-resort, employed the light for the first time. At present the electrical tramways are worked from a separate plant. It is proposed, however, to produce the current for both tramway and illuminating purposes at the one central station; and it is probable, therefore, that within a short period two more engines and dynamos will be put down at the new works. The estimate for the machinery and building was £30,000.

A Defective Reservoir Embankment at Heywood.—Subject to the approval of the Town Council, the Heywood Water Committee have decided to undertake an important work in connection with the higher reservoir at Naden. This is the oldest reservoir of the local service. It was constructed in 1847 by the late Water Company, under the superintendence of Mr. C. E. Cawley; it holds, when full, 60 million gallons; and it was the reservoir from which water was first supplied to Heywood in 1849. More recently it has been used for compensation purposes; and, under the Local Acts, the Corporation are "for ever bound to uphold and maintain" it. The reservoir, however, has long been a source of anxiety and of expense. A portion of the embankment has a tendency to "creep;" and although large sums have been expended in repairing the damage thus done, the measures taken have not had the effect of curing the mischief. The last considerable expenditure was in 1890, when about £400 was laid out in raising the embankment to the original level. Some time ago, Mr. J. Diggle, the Borough Engineer, recommended the construction of a strong concrete retaining wall at the base of the embankment, with a view to prevent further movement. This wall will have to be carried down to the rock below the shale. Mr. Diggle has satisfied himself by boring that a solid foundation can be secured, and that the projected work is likely to be effective. The cost is estimated at £8000; and if the scheme is carried out, application will be made to the Local Government Board for power to borrow the money, and to spread the cost over 60 years. Considerable difference of opinion is said to exist in the Corporation as to the desirability of the work; but the fact that at present the embankment is regarded as insecure is likely to outweigh any objection which may be raised.

Enlargement of a Gasholder at the Elland Gas-Works.—A single-lift gasholder at the Elland Gas-Works has been converted, by Messrs. Clayton, Son, and Co., of Leeds, into a telescopic one of four lifts—increasing the capacity from 240,000 to 850,000 cubic feet. The contract was completed last week; the cost being about £5000.

The Cost of a New Reservoir at Baildon.—The water reservoir which the Baildon Local Board are now having constructed is costing a great deal more than was originally estimated. Beyond a sum of £16,000 already sanctioned for the purpose, £5000 has been spent; and an application to borrow this amount formed the subject of an inquiry by Mr. F. H. Tulloch, one of the Inspectors of the Local Government Board, last Friday. Further money will also be required; and, as £21,000 is the limit allowed by the Board's Water Act of 1890, it was stated that additional borrowing powers will have to be sought under a Provisional Order.

The Adoption of Prepayment Meters at Hexham.—Mr. H. Lees, the Manager of the Hexham Gas Company, has induced his Directors to adopt the penny-in-the-slot meter; and the demand has already been most encouraging. In a little more than six weeks, they had about 30 meters in use; and, at the beginning of last week, they had applications for 20 more. For a penny the consumer receives 22½ cubic feet of gas; and this includes the loan of the gas-fittings and a griller, as well as the meter-rent. This charge is at the rate of 3s. 8½d. per 1000 cubic feet; the price to ordinary consumers being 3s. 4d. per 1000 feet, or, with the discount, 3s.

The New Water-Works for Plympton.—Colonel J. O. Hasted, R.E., of the Local Government Board, held an inquiry at Plympton on the 25th ult., into an application by the Rural Sanitary Authority for sanction to a supplementary loan of £4000, for the completion of the local water-works. It was explained that £6000 had already been borrowed and expended on the works; and the loan now asked for would bring the cost up to £10,000. At the first inquiry, estimates were submitted for an expenditure of £7284; and it was then recognized that a further loan would be necessary. In some particulars the estimates had been exceeded, and additional works had been decided upon—rendering necessary this second loan.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 442.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	13 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p. c.	10	12—13	..	5 15 4
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	102—104	..	4 16 2
100,000	20	31 May	8	Bahia, Limited	20	10½—11½	..	13 18 3
200,000	5	12 May	6¼	Bombay, Limited	5	5¼—5¾	..	5 13 0
40,000	5	,,	6¼	Do. New	4	3¾—4	..	6 10 0
380,000	Stck.	16 Aug.	11½	Brentford Consolidated	100	217—222	..	5 3 7
180,000	,,	,,	8½	Do. New	100	163—168	..	5 1 2
220,000	20	15 Mar.	11½	Brighton & Hove Original	20	41—43	..	5 6 11
888,500	Stck.	31 Aug.	5	Bristol	100	102-105*	+½	4 15 3
320,000	20	13 Apl.	11¼	British	20	42—44	..	5 4 7
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	15—16*	+½	5 6 3
328,750	10	28 July	2	Buenos Ayres (New) Limited	10	5¼—6¼	..	3 1 6
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	97—100	..	6 0 0
150,000	20	13 July	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	28 Apl.	12½	Commercial, Old Stock	100	243—248	..	5 0 10
165,000	,,	,,	9½	Do. New do.	100	185—190	..	5 0 0
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	125—130	..	3 9 3
800,000	Stck.	15 June	13	Continental Union, Limited	100	228—233	..	5 11 6
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Mar.	10	Crystal Palace District	100	190—195	..	5 2 7
486,090	10	28 July	10	European, Limited	10	21—22	..	4 10 11
354,060	10	,,	10	Do. Partly paid	7½	15—16	..	4 13 9
5,646,590	Stck.	16 Aug.	12	Gaslight & Coke, A, Ordinary	100	223—228	..	5 5 3
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	94—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	260—265	..	3 15 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	120—125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	175—180	..	4 3 4
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	168—173	+1	4 0 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	259—264	..	3 15 9
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	155—160	..	3 15 0
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	126—129	+1	3 2 0
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	128—132	..	3 8 2
908,000	,,	,,	6	Do. 6 p. c. do	100	172—177	..	3 7 9
3,800,000	Stck.	12 May	12	Imperial Continental	100	223—228	..	5 5 3
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	5—5½	..	5 9 1
560,000	100	4 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	100	103—105	..	4 15 3
541,920	20	15 June	5	Monte Video, Limited	20	12¼—13½	..	7 8 2
150,000	5	31 May	10	Oriental, Limited	5	7½—8	..	6 5 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	4—4½	—¼	7 15 6
166,870	10	—	2	Pará Limited	10	2—2½	..	—
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	100—105	..	5 14 3
500,000	100	1 June	6	2nd Do.	100	98—102	..	5 17 8
150,000	10	28 Apl.	5	San Paulo, Limited	10	8½—9½	..	5 5 3
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	292-297*	+2½	5 4 4
1,350,000	,,	,,	12	Do. B do.	100	240-245*	+2½	4 17 11
260,000	,,	,,	13	Do. C do.	100	247-252*	+½	5 3 2
750,000	,,	13 July	5	Do. 5 p. c. Deb. Stk.	100	148—152	..	3 5 9
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	210—215*	..	5 7 0
				WATER COMPANIES.				
744,897	Stck.	29 June	10	Chelsea, Ordinary	100	263—268	..	3 14 7
1,720,252	Stck.	29 Mar.	8	East London, Ordinary	100	213—218	..	3 13 5
544,440	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	100	140—143	..	3 2 11
700,000	50	15 June	8½	Grand Junction	50	110—113	..	3 15 2
708,000	Stck.	16 Aug.	11	Kent	100	275—280	..	3 18 6
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	100	239—241	..	3 17 10
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197—202	..	3 14 6
310,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	129—132	..	3 0 7
500,000	100	16 Aug.	12½	New River, New Shares	100	325—330	..	3 13 6
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132—135	..	2 19 3
902,300	Stck.	15 June	6	S'thwk & V'xhall, 10 p. c. max.	100	149—154	..	3 18 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	140—145	..	4 2 9
1,155,066	Stck.	15 June	10	West Middlesex	100	258—263	..	3 16 0
						*Ex Div		

The Testing of Gas-Meters in Edinburgh.—In the course of his annual report, Mr. John Jack, the Chief Inspector of Gas-Meters to the Edinburgh Corporation, says that his department was inaugurated in 1861, when the Sales of Gas Act was passed; but that it is not so well known to the public as it deserves. Last year 42,004 meters were tested. Of this total 17,873 were wet meters, and 24,131 dry mete.s. Of the whole, 32 wet meters and 147 dry meters were found faulty, and were rejected. The fees received by the department for stamping and certifying meters during the year amounted to £1337 13s. 6d.; being an increase on the previous year of about £102. There were 3396 meters more tested in the course of last year than in the previous twelve months. The increase in the work of the department has been marked. In 1864-65 the total meters inspected only numbered 29,523; and the fees amounted to £868. In 1887-88 the returns showed that there were 33,287 meters tested; and the fees amounted to £1098 8s. In the first year of the department, the total inspected was 37,605; and the fees were £1012 17s. 6d. The fees in the past year ranged from 6d. to 60s. per meter. Besides having housed within his offices the Corporation testing-machines, Mr. Jack has charge also of three beautiful instruments belonging to the Board of Trade. They are the only ones in Scotland; and are located in Edinburgh so that the standards of other towns may be rectified by them. It is interesting to note that the Edinburgh gas-meter inspector's department is the only one throughout the country that pays and makes a profit.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

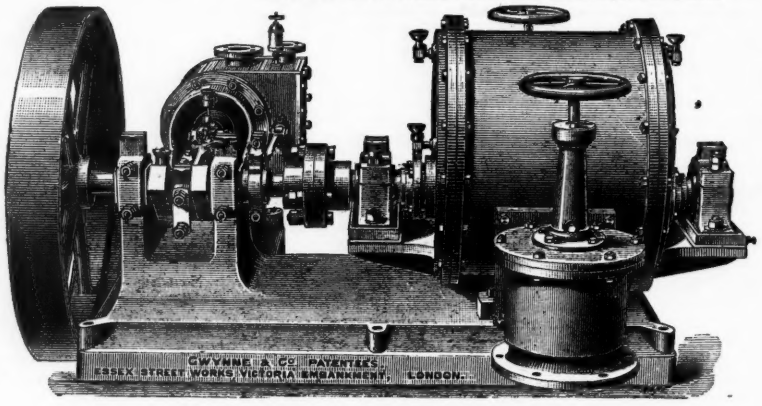
Late Essex Street Works, Victoria Embankment, London, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent.
Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

VOLCANIC Fire Cement (Winkelmann's)
Fire Resistance 4500° Fahr.
ANDREW STEPHENSON, Sole Agent, 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.
Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

SADLER AND CO., LIMITED,
MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

WANTED, Gas Liquor.
Address GEORGE DOBSON, LIMITED, CARDIFF.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

MR. J. C. CHAPMAN, Fellow of the Chartered Institute of Patent Agents, advises on all matters connected with LETTERS PATENT FOR INVENTIONS and the PROTECTION OF TRADE MARKS, &c., at home and abroad. Preliminary Information and Handbook on application.
70, Chancery Lane, LONDON, W.C.

LIQUOR, Tar, and Spent Oxide wanted.
BROTHERTON AND CO., Ammonia and Tar Distillers, BIRMINGHAM, LEEDS, and WAKEFIELD.

WANTED, Two Steady Men as STOKERS.
Apply to the MANAGER, Gas-Works, CHERTSEY.

CARMARTHEN GAS COMPANY.

WANTED, a young Man competent to inspect and fix Meters, lay Main and Service Pipes, and to make himself useful as General Foreman of indoor and outdoor work. Wages 28s. per week.
Applications, stating age and experience, with reference as to character and last employment, to be addressed to,
B. A. LEWIS,
Manager and Secretary.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE & CO., direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore.
Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

MESSRS. DEBENHAM, TEWSON, FARMER, and BRIDGEWATER'S MONTHLY LIST of Shops, Show-Rooms, Factories, and Waterside Premises, suitable for the Exhibition and Manufacture of Engineering and other Appliances, may be obtained, free of charge, at their Offices, 80, CHEAPSIDE, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors, for the erection of Gas-Works for Towns, Villages Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER, LINCOLN."

WANTED, a re-engagement as Retort SETTER. Over 20 years' practical experience. Can work to any Plan or Setting.
Address No. 2274, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

THE Engineer of a large Gas-Works, offering exceptional advantages, has a VACANCY for a PUPIL.
Apply, by letter, to No. 2276, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

G. L. LAMBERT, 26, Alberta Terrace, Nottingham. Consultations, Advice, Reports in Various Branches of **Practical** Mechanical Engineering and Machinery. **Specialities** in Water, Sewage, and Gas Plant Making. **Surveyor** of Steam-Ships, Marine Engines, Boilers, and General Machinery. **Detailed Inspection** of Engineering Contracts during Manufacturing and Erection.

WANTED, a Good Stoker. Must be a steady and trustworthy Man. Used to Shovel charging and Engine and Exhauster. Permanency to a good Man.
Apply to the MANAGER, Gas-Works, Maldon, ESSEX.

DRAUGHTSMAN and Designer wanted. Wrought Iron and Art Metal Work. Well experienced, and must be able to estimate his own work. If with knowledge of outside Lamp Trade preferred.
Apply, by letter, with specimens of work, and stating full particulars as to experience, age, and present salary, to the SECRETARY, Evered and Co., Limited, 28, Drury Lane, LONDON.

EMSWORTH GAS AND COKE COMPANY.

WANTED, a handy Mechanic as WORKING FOREMAN for a Small Gas-Works on the South Coast; one used to Forge work, Main and Service laying, and Meter reading. House, with good Garden, Gas, and Coal.
Apply, with testimonials, stating age, wages required, and present occupation, to J. W. LOADER COOPER, Esq., Solicitor and Secretary, Queen Street, EMSWORTH.

GAS STOKER.

WANTED, a good steady Man (not over 32 years of age) as STOKER. Must be used to charging Retorts with shovel. One who thoroughly understands a Steam-Boiler, Engine and Exhauster, and can make himself generally useful. A single Man preferred. Wages 27s. per week.
Apply, at once, with character, stating age, experience, whether married or single, and when candidate would be prepared to enter on his duties, to
W. C. DAWSON,
Manager.
Gas-Works, Arundel, Sussex.

PURIFIERS.

FOR SALE—Four 5 feet Square PURIFIERS, in good condition, lying at Filey.
Apply to HENRY TOBEY, Gas-Works, MALTON.

FOR SALE—A Round Station Meter, in excellent condition. Capacity, 8000 cubic feet per hour, with Clock, Tell-Tale, Inlet, Outlet, and Bye-Pass Valves, and Connections complete. Replaced by one of larger capacity.
Apply to the undersigned.
JNO. SWAN,
Engineer and Manager.
Gas-Works, Ulverston,
Aug. 28, 1893.

GAS-WORKS DEBENTURES AND PREFERENCE SHARES.

TO BE SOLD—£3500 of each of the above in an English Company having Gas-Works in the West Indies.
They will be sold to pay 9 per cent.
Apply to Messrs. WARNER, WALDUCK, AND Co., 184, Gresham House, LONDON, E.C.

FOR SALE—Two Drawing and Two Charging hand-power STOKING-MACHINES by West's Gas Improvement Company, capable of working Retorts up to 6 feet from Stage Level, with a maximum charge of 3 cwt. per Mouthpiece. In thoroughly good working condition, complete with Travelling Scoops and Hoppers, spare Rake-Heads, Rods, Propelling Gear, &c., &c.; but with no Rails, Coal-Breakers, or Lifting Machinery.
To be seen at the Kent Road Works of the South Metropolitan Gas Company, and offered at a very low price.

FOR SALE, the following second-hand GAS PLANT:—
GASHOLDER, 35 ft. by 14 ft.
GASHOLDER and Cast-Iron TANK, 30 ft. by 17 ft.
Four PURIFIERS, 12 ft. square by 4 ft. 6 in. deep.
Cast-Iron SCRUBBER, 36 ft. high by 10 ft. diameter.
CONDENSERS to pass 500,000 cubic feet per diem.
EXHAUSTER to pass 20,000 cubic feet per hour.
Also various other sizes of above or any Gas Plant. Inquiries invited.
Apply to SAML. WHILE, 60, QUEEN VICTORIA ST., E.C.

SPECIAL BARGAIN.

FOR SALE—Two perfectly new Cast- Iron SCRUBBERS, 10 feet diameter by 50 feet high, with Wrought-Iron Domes, Cast-Iron Spiral Staircase, &c., complete. All plates machine planed. One or both Scrubbers will be sold to suit purchasers.
A perfectly new 30,000 per hour HORIZONTAL DOUBLE PUMP RECIPROCATING EXHAUSTER, with Steam-Engine, with Connections and Valves.
One Second-hand (thoroughly overhauled) VERTICAL PUMP EXHAUSTER, with Steam-Engine (with clean Water and Liquor Pumps attached), to pass 7000 cubic feet of Gas per hour.
The whole of the above Plant can be inspected, and full particulars with prices will be sent, on application to No. 2241, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TENDERS wanted for about 2000 tons of Flint Colliery CANNEL, in stock at Colliery. Price to include loading into Trucks. Analysis on application.
Apply to the NEW FLINT COAL AND CANNEL COMPANY, 5, Windsor Buildings, George Street, LIVERPOOL.

TO SULPHATE PLANT MAKERS.

THE Gas Committee of the Penrith Local Board invite TENDERS for the supply and erection of a SULPHATE OF AMMONIA PLANT, capable of producing 2 tons of Sulphate in 48 hours.
Plan of House and Specification may be seen on application to Mr. E. Shaul, Gas-Works, Penrith.
Sealed tenders, endorsed "Sulphate Plant," must be delivered to me not later than Saturday, Sept. 16.
GEORGE WAINWRIGHT,
Clerk to Board.
Public Offices, Penrith,
Sept. 1, 1893.

NORTHAMPTON GASLIGHT COMPANY.

TENDERS FOR TAR.

THE Directors are prepared to receive TENDERS for the purchase and removal of the surplus TAR produced at their Works for a term of One or Two Years.
Quantity produced, about 2400 tons per annum.
Particulars may be had on application.
The Directors do not bind themselves to accept any tenders.
Tenders, marked "Tender for Tar," to be delivered at the Company's Offices on or before Tuesday, Sept. 19 next.
JOHN EUNSON,
Engineer.
Gas-Works, Northampton,
Aug. 30, 1893.

CORPORATION OF LEICESTER.

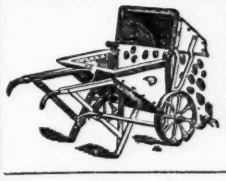
ELECTRIC LIGHTING CENTRAL STATION.
IRON ROOFING.

THE Gas Committee of the above Cor- poration are prepared to receive TENDERS for the supply and erection of two ROOFS, one 139 ft. long, 40 ft. span, and one 60 ft. long, 40 ft. span.
Drawings may be seen and Specification and Form of Tender obtained, upon application to the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Roofs," to be delivered at these Offices, not later than Eleven o'clock a.m., on Saturday, Sept. 23.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M. Inst. C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane,
Leicester, Sept. 1, 1893.

NOW READY.
GAS AND WATER CO.'S DIRECTORY, 1893.
Seventeenth Annual Issue, 5s.
GAS-WORKS STATISTICS, 1893.
Fifteenth Annual Issue, 3s. 6d.
WATER-WORKS STATISTICS, 1893.
Thirteenth Annual Issue, 2s. 6d.
Handsomely Bound in One Vol., Price 10s.
LONDON: HAZELL, WATSON, & VINEY, Ltd., 1, CREED LANE, E.C.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.
Prices and Analysis of all the Scotch Cannels on application.

PRICE'S PATENT COKE & COAL BARROW



effecting a great saving of time labour, and expense.
For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.
Prices are Reduced.

HEBBURN MAIN GAS COALS.
Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.
For prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street, NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

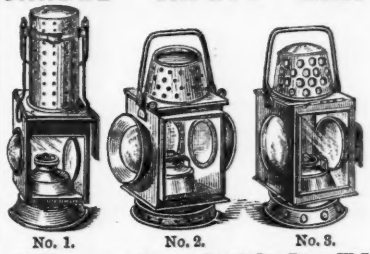
HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER PORT GLASGOW."
Established 1872.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.
Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from
C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

AUG. KLÖNNE,
DORTMUND (GERMANY).
REGENERATIVE FURNACES.
Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

ARMSTRONG'S PATENT
CANDLE SAFETY LAMPS



No. 1. No. 2. No. 3.
43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by
Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegrapb, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE

BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,

(Established 1851,)

Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.
SCULCOATS, HULL.

JAMES WHITE & CO., LTD.,

WIDNES, LANCASHIRE,
Manufacturers of Special

FIRE-BRICKS, FIRE-CLAY, & FURNACE CEMENT.

FOR GAS FURNACES our GANNISTER and SILICA FIRE-BRICKS are acknowledged to be the best and most durable in the Market.

GANNISTER and SILICA FIRE-CLAY guaranteed of the Purest Quality.

FURNACE CEMENT specially made for repairing Furnaces and stopping Cracks.

ANALYSIS AND REFERENCES ON APPLICATION.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.,
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton	10,500	Cubic Feet.
Illuminating Power	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

THORNLEY GAS COALS

WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.

Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13⅓ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

NIDDRIE CANNEL

A FIRST-CLASS CANNEL COAL,

Yielding a large volume of rich Gas, and fully 60 per cent. of first-class Coke.

FOR ANALYSIS, PRICE, AND ALL OTHER PARTICULARS, APPLY TO

The Niddrie & Benhar Coal Co., Ltd.,
15, HANOVER STREET,
EDINBURGH.

Telegrams: "BENHAR, Edinburgh."

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

FAMOUS LEESWOOD

"CURLEY CANNEL."

YIELD: 15,306 CUB. FT. PER TON OF 30·62-CANDLE POWER.

SMOOTH CANNEL.

YIELD: 12,321 CUB. FT. PER TON OF 21·321-CANDLE POWER.

PRICES AND PARTICULARS OF
MESSRS. S. CHANDLER & SONS
LEESWOOD COAL AND CANNEL MINES,
PONTYBODKIN, nr. MOLD, NORTH WALES.

ALEX. C. HUMPHREYS, M.E.,
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A.

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

MIDLAND DISTRICT OFFICE: 22, TEMPLE ST., BIRMINGHAM—SOLE AGENT: A. C. SCRIVENER.
TELEGRAPHIC ADDRESS: "WIGAN BIRMINGHAM." TELEPHONE No. 200.
LONDON DISTRICT OFFICE: 6, STRAND, LONDON—C. PARKER & SON, SOLE AGENTS.
TELEGRAPHIC ADDRESS: "PARKER LONDON."

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,
PAISLEY, N.B.,

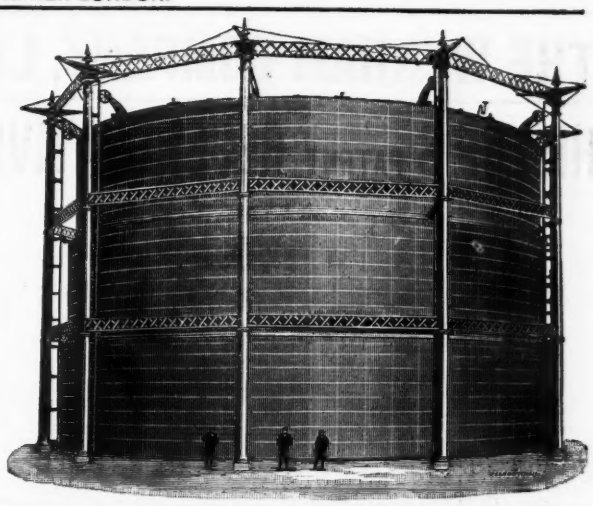
MAKERS OF

Gasholders and Gas Plant

OF EVERY DESCRIPTION.

Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

Telegraphic Address: "Donald Paisley."



G. WALLER & CO.'S NEW PATENT GAS EXHAUSTER

MADE WITH FOUR BLADES,

To pass 300,000 Cubic Feet per Hour, with or without Engine combined.

IN USE AND ON ORDER FOR OVER 100 WORKS,
AND EQUAL TO
5,340,000 CUBIC FEET PER HOUR.

SPECIAL ADVANTAGES:—

The Four-Blade Exhauster PASSES 50 PER CENT. MORE PER REVOLUTION than any One or Two Blade Exhauster.
It takes 27 per cent. less power than any Two-Blade Exhauster.
It gives a steadier Gauge than any other Exhauster.
One of our 150,000 feet per hour Patent Four-Blade Exhausters passes continuously 180,000 cubic feet per hour, driven by a 12-INCH STEAM CYLINDER. No other Maker can give a similar result.
Model of Patent Exhauster sent for inspection.
Oldest Makers of Beale Exhausters for over 300 Works.
Patent Compensating Steam Governor, Special Tar and Liquor Pumps, Gas-Valves.
Washer-Scrubbers, with WOOD CLUSTERS, and Tar Extractor combined.

PHŒNIX ENGINEERING WORKS,
PARK STREET, SOUTHWARK, LONDON, S.E.

JOHN BROWN & CO., LTD., SHEFFIELD,

Proprietors of

ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

WENHAM LAMPS

With Recent Improvements.

PRICES

FROM

STILL THE BEST REGENERATIVE LAMP.

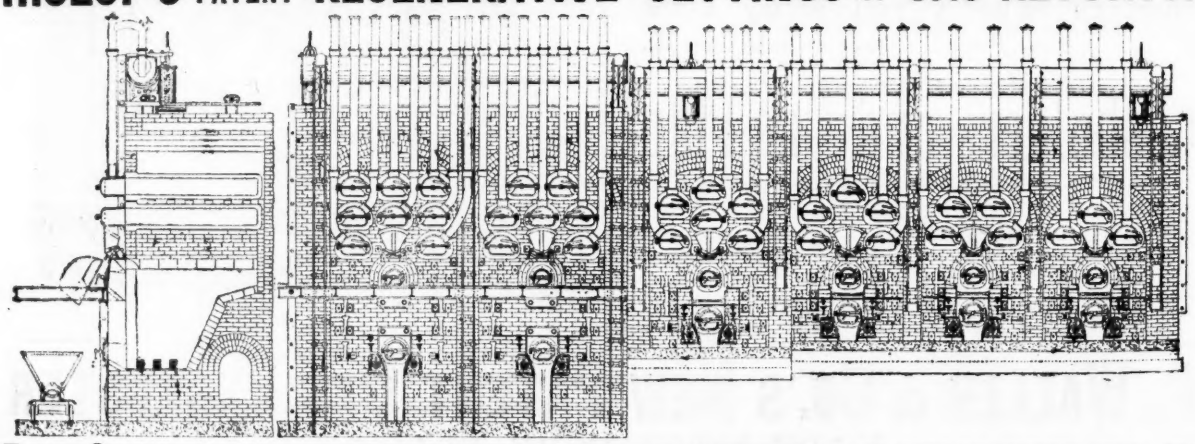
20/-

CHEAPEST! MOST ORNAMENTAL AND RELIABLE!

APPLY FOR NEW SEASON'S CATALOGUE.

THE WENHAM COMPANY, LTD. UPPER OGLE STREET, LONDON, W.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE ADAPTED TO THE REQUIREMENTS OF ALL GAS COMPANIES AND GAS CORPORATIONS, AND HAVE ALREADY BEEN EXTENSIVELY ADOPTED. THEY ARE ERECTED UPON BOTH THE WORKING-STAGE AND SHALLOW-CHAMBER SYSTEMS, AND EQUALLY SATISFACTORY RESULTS ARE GUARANTEED IN BOTH CASES.

THE SETTINGS HAVE ATTAINED TO A MEASURE OF SUCCESS AND POPULARITY QUITE UNEQUALLED BY THAT OF ANY OTHER WITHIN THE SAME SPACE OF TIME. THE WORKING RESULTS OBTAINED, AND THE GENERAL SATISFACTION GIVEN, ARE DECLARED IN EVERY CASE TO EXCEED, AND IN MOST CASES CONSIDERABLY EXCEED, THE PATENTEE'S GUARANTEE. THE CONSTRUCTION AND WORKING OF THE PATENT PRODUCER AND THE PATENT CHARGING APPARATUS FOR SAME ARE ABSOLUTELY UNIQUE AND UNRIVALLED, AND ARE THE DELIGHT OF EVERY STOKER; WHILE IN EVERY OTHER PARTICULAR THEY SECURE THE HIGHEST RESULTS ATTAINABLE BY ANY REGENERATIVE SYSTEM, AND AT A MINIMUM OF COST.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings, or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stewart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge, and from R. F. HISLOP (son of Patentee), Gas-Works, Paisley.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED, AND AFFORDING THE HIGHEST SATISFACTION.

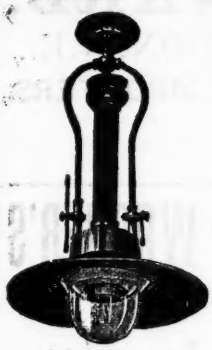
SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S PATENTS.

All Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

THE "METEOR" HIGH-POWER GAS-LAMP.



CLASS B.

The cheapest, and most simple
The most economic, and most durable
The most brilliant, and best ventilating
And the most easily cleaned

} REGENERATIVE Lamp.

HAS BEEN AWARDED 8 GOLD AND SILVER MEDALS.

FOR INDOOR AND OUTDOOR LIGHTING.

The "Meteor," being made entirely of fine cast iron, is practically indestructible.

Prices from 53s. per Lamp, with improved Governor and extra Accessories complete.

COUNTRY AGENTS WANTED. REDUCED PRICES.

LIBERAL TERMS TO GAS COMPANIES AND TO THE TRADE.

Applications for Price Lists, Terms, and Agencies to be made to

W. J. MOORE,

Sole Manufacturer's Representative,

Offices and Show-Room: 83, UPPER THAMES STREET, LONDON, E.C.

THE SILICA FIRE-BRICK COMPANY,

OUGHTYBRIDGE, NEAR SHEFFIELD.

Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.

MANUFACTURERS OF

SILICA FIRE-BRICKS,

(TRADE MARK "SILICA")

Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.

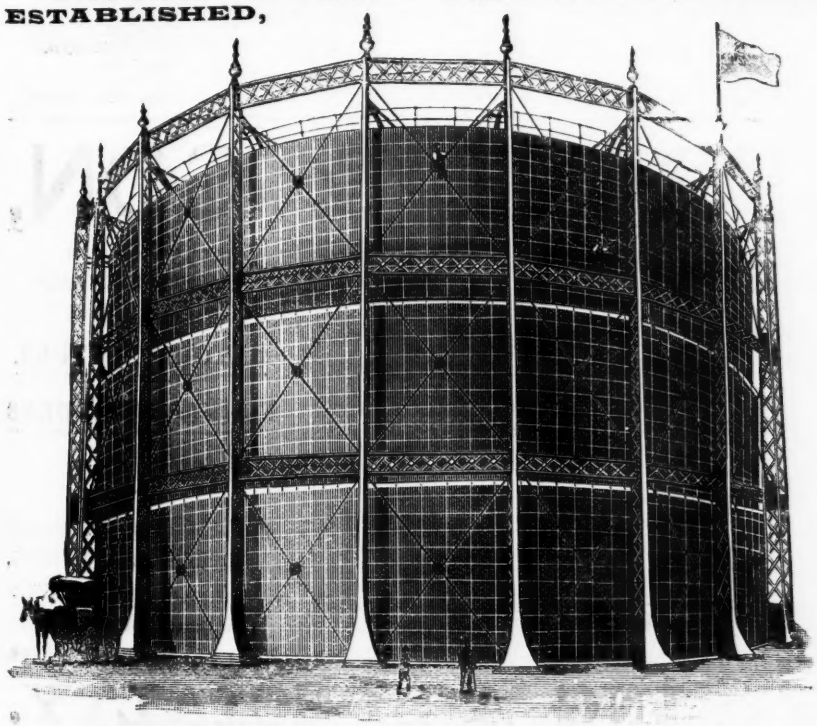
BESSEMER GANNISTER, STEEL-FURNACE GANNISTER, COPPER-FURNACE GANNISTER, IRONFOUNDERS' CUPOLA SAND, FINE-SETTING SILICA CEMENT, STEEL MOULDERS' COMPOSITION.

Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

R. DEMPSTER & SONS, Ltd.,

ROSE MOUNT GAS ENGINEERING WORKS,

ESTABLISHED, 1855



RETORT-FITTINGS,
CONDENSERS,
EXHAUSTERS,
PURIFIERS,
SULPHATE PLANTS,
AND EVERY DESCRIPTION OF
Gas and Chemical Plant.

ELLAND.

The above illustrates a TREBLE-LIFT GASHOLDER, 194, 191, and 188 feet diameter by 85 feet deep each, as made for the MELBOURNE GAS COMPANY.

The Gasholder sheets are levelled by machinery, and are afterwards sheared, squared, and punched by an Improved Combined Multiple Punch and Shearing Machine, which also punches the circumferential seams of crown sheets by special punches and dies, ensuring perfect accuracy, avoiding rimering in erection.

CARLESS, CAPEL, & LEONARD,

HOPE CHEMICAL WORKS, HACKNEY WICK, LONDON, N.E.,

NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,

Specially prepare GASOLINE, specific gravity ·650; CARBURINE, specific gravity ·680; or any other Hydrocarbon best adapted for Carburetting Gas.

Prices and Samples may be had upon application.

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
OXO	"JACKSON"	BECK & Co.,
MARK.	CLAY CROSS.	130, ST. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

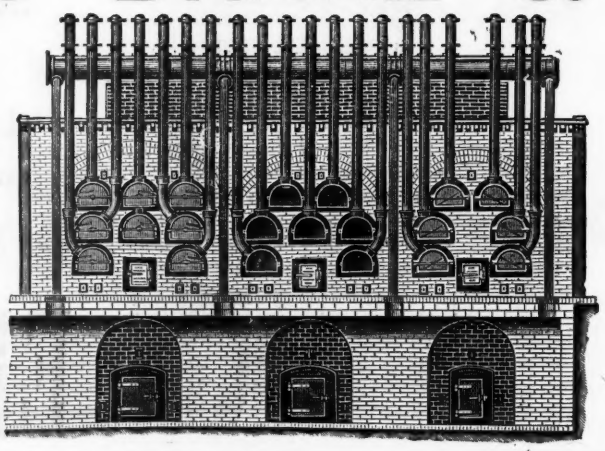
JONAS DRAKE & SON,

TELEGRAPHIC ADDRESSES
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON"

TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.



RETORT SETTERS,
FURNACE BUILDERS
ETC., ETC.

REGENERATOR AND GENERATOR FURNACES ON DRAKE'S, FRITH'S, SIEMENS'S, KLONNE'S, HASSE'S VALON'S, SOMERVILLE'S, PONSARD'S and other Principles.

INCLINED RETORTS

GASEOUS FIRING A SPECIALTY.

RETORT SETTING IN ALL ITS PRINCIPLES AND BRANCHES. BENCHES FITTED UP COMPLETE.
DRAWINGS, SPECIFICATIONS, AND ALL OTHER PARTICULARS ON APPLICATION.

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

OVENDEN, HALIFAX.

R. & J. DEMPSTER,

GAS PLANT WORKS,

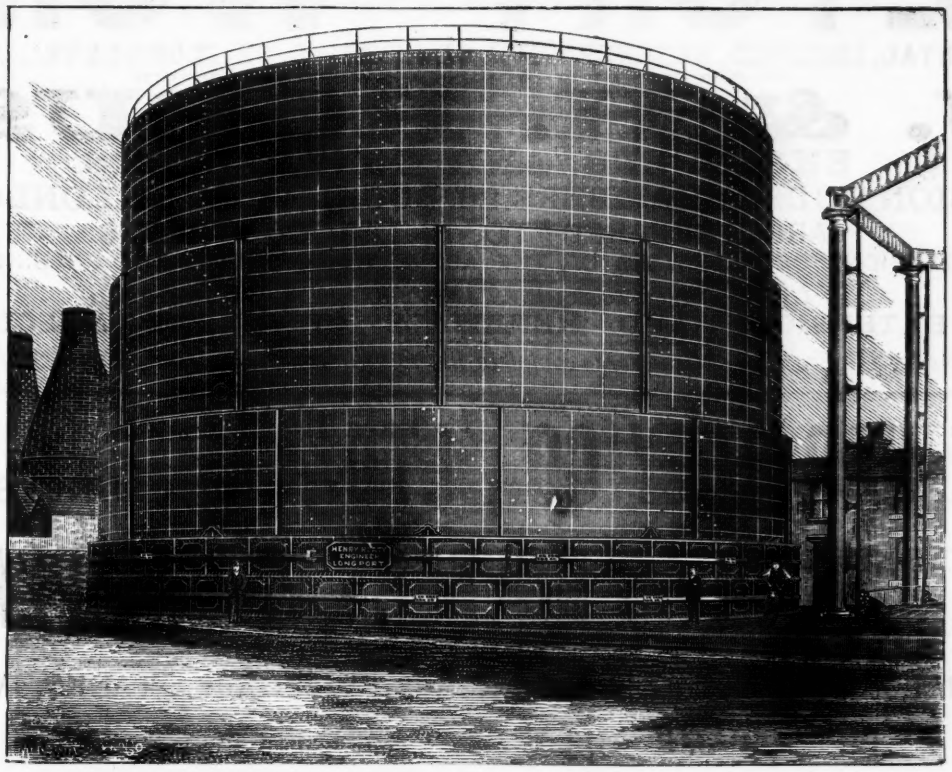
NEWTON HEATH, MANCHESTER.

Makers of every kind of Gas Apparatus and Structural Ironwork.

Sole Licensees of

SPIRAL-GUIDED GASHOLDERS,

WHEREBY COSTLY GUIDE-FRAMING IS DISPENSED WITH.



Telegraphic Address: "SCRUBBER MANCHESTER."

Further Particulars and Estimates on Application.

Three-Lift Spiral-Guided Gasholder, working in a Cast-Iron Tank made with planed joints, erected at the Longport Gas-Works of the Burslem Corporation. Bottom Lift, 90 ft. diameter and 20 ft. deep.

NOTHING SUCCEEDS LIKE SUCCESS.

Upwards of thirty Gasholders have now been erected or ordered upon this System; and their stability has been proved under the most varied conditions. A list of these will be sent on application.

The reader's attention is invited to the fact that our position as Makers of **SPIRAL-GUIDED GASHOLDERS, THE SAFEST AND BEST** of the several types of Columnless Gasholders, has not been modified by any recent adjustment of legal proceedings.

IMPORTANT TO ENGINEERS AND GAS COMPANIES.

A NEW CARBURETTOR FOR ENRICHING GAS IN BULK.

The Carburettors have been doing practical work for the past two years; in many cases doing all the enrichment without the use of Cannel or other rich Coals. The South Metropolitan Gas Company have these Enrichers at all their Stations. The Gaslight and Coke Company have had them in use at some of their principal Works for two years past; and several more are now being fixed at their other Stations. The Carburettors are also in use at several Suburban and Provincial Gas Companies' Works.

FOR PRICES AND FULL PARTICULARS, APPLY TO

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON.

RETORT WORK

HORIZONTAL, INCLINED, REGENERATIVE, GENERATIVE, OR FLOOR-LEVEL SETTINGS.

J. & H. ROBUS,

ENGINEERS. AND CONTRACTORS,

MANSION HOUSE CHAMBERS, 20, BUCKLERSBURY, LONDON, E.C.

ARE PREPARED TO ENTER CONTRACTS

FOR EXTENSIONS OR RENEWALS OF THE ABOVE WORK DURING THE ENSUING SEASON.

PLANS, SPECIFICATIONS, AND ESTIMATES SUBMITTED

FOR EXTENSIONS AND RENEWALS OF EVERY DESCRIPTION.

Contractors for the Erection of Gas-Works complete, including Gasholder Tanks of all sizes and Main Laying.

THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

MAKERS OF

GAS HOLDERS & GAS PLANT.

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES,

PIPES, LAMP PILLARS, RETORT-FITTINGS, Etc.

ALSO ALL KINDS OF

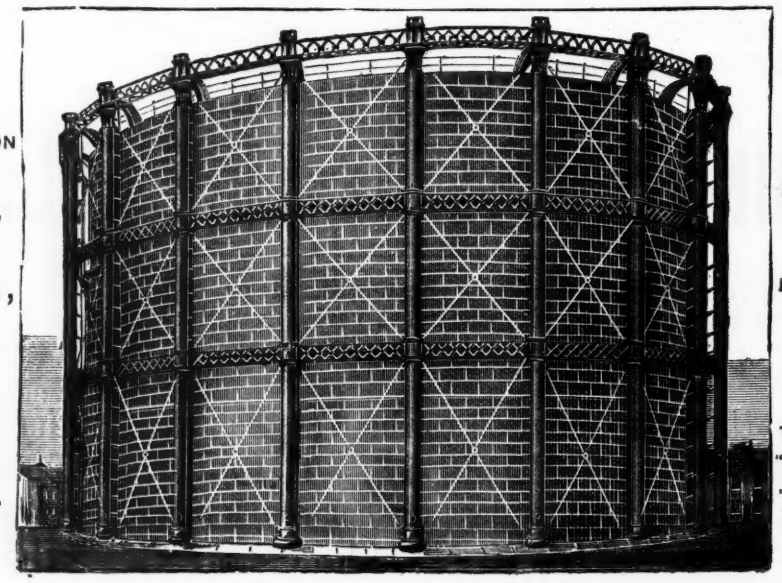
STRUCTURAL IRON

AND STEEL WORK,

BRIDGES,

ROOFS,

PIERS, ETC.



WORKS AND HEAD OFFICE:
TIPTON,
STAFFORDSHIRE.

LONDON OFFICE:
11, VICTORIA ST.,
WESTMINSTER.

TELEGRAPHIC ADDRESSES:
"HORSELEY, TIPTON."
"GALILEO, LONDON."

IRISH OXIDE OF IRON.

GAS PURIFICATION.

RIKY'S OXIDE (formerly worked by Messrs. Stanley and Olphert).

THE LARGEST SUPPLY OF OXIDE IN HAND OF ANY OTHER FIRM IN THE WORLD.

Purity and Uniformity of Quality Guaranteed.

RIKY AND CO. can supply the above at a much lower rate than any other firm in the trade, being owners of the property where it is found. *No Middleman or Agent* receives a profit.

SAMPLE AND PRICE ON APPLICATION.

Address **JOHN RIKY AND CO., Killygordon, County Donegal; and 193, Great Brunswick St., Dublin.** Telegrams: "RIKY, KILLYGORDON."

HARPER & MOORES,

STOURBRIDGE.

MANUFACTURERS OF

BEST FIRE-BRICKS, GAS-RETORTS,

LUMPS, TILES, AND ALL ARTICLES IN FIRE-CLAY.

Proprietors of Best Glasshouse Pot, Crucible, and other Stourbridge Clays.

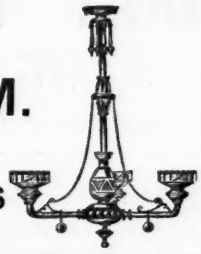
MANUFACTURERS OF GLASSHOUSE POTS AND CRUCIBLES OF EVERY KIND.

ESTABLISHED 1836.

OSLER,

BIRMINGHAM.

MANUFACTURERS OF GASELIERS IN GLASS AND METAL.



Gas-Bags for Mains. High-Water Boots. Woollen Miners' Jackets.

Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpaulin Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber. Stokers' Gloves, 14s. per dozen.

Write for Price List to

THOMAS BUGDEN, Manufacturer,

116 & 118, GOSWELL ROAD, LONDON, E.C.

JOSEPH CLIFF & SONS,

INCORPORATED IN

THE LEEDS FIRE-CLAY COMPANY, Ltd.,

WORTLEY, LEEDS.

LONDON Offices & Depôts:

Baltic Wharf, Waterloo Bridge.

WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

LIVERPOOL:

16, Lightbody Street.

LEEDS:

Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

TELEGRAPHIC ADDRESS, "GAS LEEDS."

LONDON OFFICE, 60, QUEEN VICTORIA STREET, E.C.

CLAYTON, SON, & Co.

LIMITED,

LEEDS,

MAKE

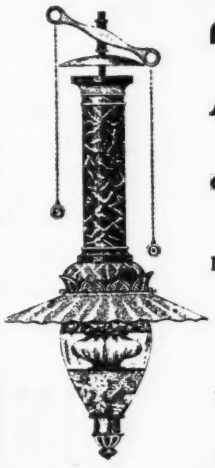
RETORT LIDS

OF ALL FORMS AND SHAPES IN IRON OR STEEL

BY SPECIAL HYDRAULIC MACHINERY.

PRICES ON APPLICATION.

The Climax of Regenerative Gas Lighting!!



THE

"VERTMARCHE"

A 280-CANDLE POWER PLAIN IRON LAMP,

CLASS A— 55/-

LIGHT for LIGHT

less than half the price of any other Regenerative Lamp.

Manufactured in England by

HENRY GREENE & SONS,

153 & 155, CANNON STREET, LONDON BRIDGE, E.C.

PARTICULARS AND PRICES FREE. AGENTS WANTED.

S. PONTIFEX & CO.,

GAS & WATER ENGINEERS,

22, COLEMAN ST., LONDON, E.C.,

Manufacturers of

STREET LAMPS for HOME & EXPORT.

ALL REQUISITES FOR STREET LIGHTING.

HIGH-POWER LANTERNS FOR REFUGES & OPEN SPACES.

IMPROVED STREET-LAMP REGULATORS AND LAMP TAPS.

THE VAUXHALL.

FLAT-FLAME GOVERNOR BURNERS,

Suitable for FACTORIES, OFFICES, and all Open Lights,

at 15s. per dozen.

PATENT LAMPLIGHTERS' TORCHES.

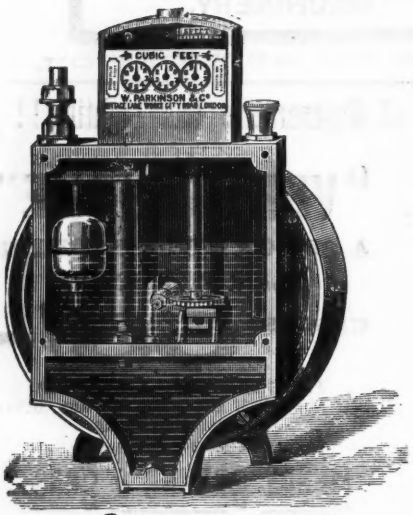
COLUMNS for GAS or ELECTRIC LIGHTING.

Works: 18, STEPHEN STREET, TOTTENHAM COURT ROAD, W.

W. PARKINSON & CO.

ESTABLISHED 1816

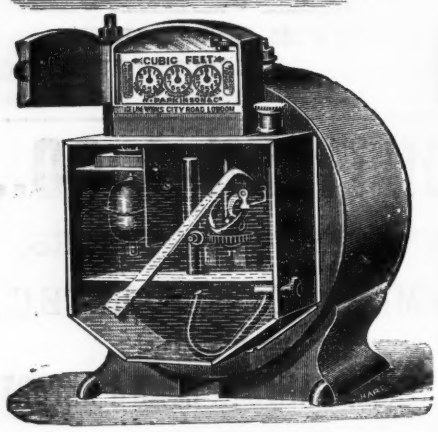
THE ORIGINAL MANUFACTURERS OF WET METERS.



ORDINARY WET METERS

IN CAST-IRON CASES.

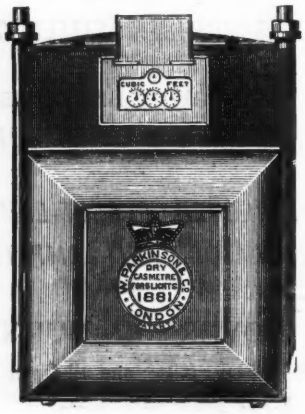
Work with very little friction. Will stand very high pressures. Cannot possibly be shut off by sudden increase of pressure, the Float being affected by Outlet Gas only. Allow for loss of water by evaporation without materially affecting the registration or shutting off the gas. Unexcelled for simplicity of construction, excellence of workmanship, or accuracy in registration.



COMPENSATING METERS

IN TINNED OR CAST-IRON CASES.

The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.



DRY METERS.

These Meters are unsurpassed for accuracy of registration. The cases are made of the best Charcoal Tin Plates; and each part of the Meter is stamped by special Machinery to ensure uniformity and exactness in construction. The Diaphragms are all of the best Persian Sheep Skins, carefully selected and the brasswork and smaller fittings are of superior workmanship.

COTTAGE LANE WORKS, CITY ROAD, **LONDON.** Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS, **BIRMINGHAM.** Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE, **MANCHESTER.** Telegraphic Address: "PRECISON."

See also Advt. p. 438.

London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at 11, Bolt Court, Fleet Street, in the City of London,—Tuesday, Sept. 5, 1893.